



Apple Service
Technical Procedures
Macintosh Family
Volume Three

CUTOFF

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the cutoff adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced.

1. Turn the monitor power OFF and remove the video cable.
2. Turn the monitor power ON and let the monitor warm up for 10 minutes.
3. Preset the BRIGHTNESS control to its center "detent" position.
4. Preset the CONTRAST control to maximum (full clockwise).
5. Preset all 8 controls on the B board to midrange (the B board controls are visible in Figure 1).
6. Set up a voltmeter as shown in Figure 1.
7. Set the red cathode (test point KR on the

C board) to 140 VDC by slowly adjusting the red background (R.BKG) control on the B board.

8. Repeat the previous step for the green and blue cathodes (KG and KB) by adjusting their respective G.BKG and B.BKG controls.
9. Adjust the CUTOFF control on the H board until the raster just appears. Then back it off until the raster (just) completely disappears. If you are unable to complete this step successfully, stop the adjustment procedure because a repair is needed!

CAUTION: If the cutoff is set too high, the monitor could automatically shut down.

10. Perform the white balance adjustment on the reverse side of this card.

IMPORTANT: The CUTOFF control must not be touched again unless all the above steps are repeated. Improper cutoff adjustment will degrade monitor performance and severely reduce the life of the CRT.

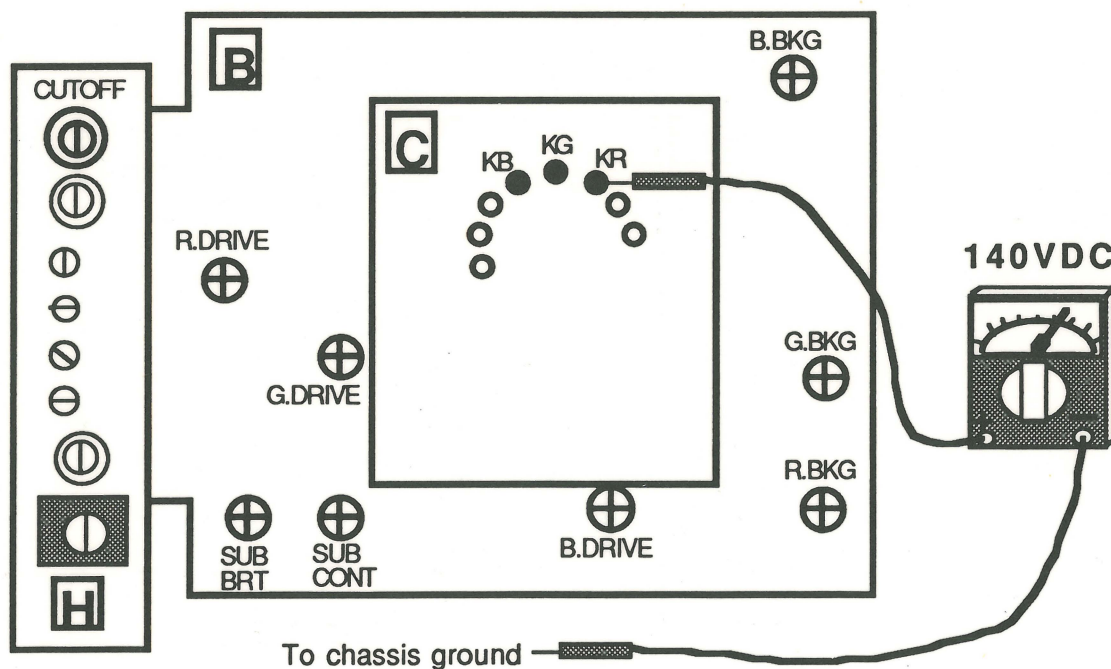


FIGURE 1

WHITE BALANCE

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the white balance adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced. The white balance adjustment should only be made when you are certain the CUTOFF control is set correctly and the monitor has been on for at least 10 minutes.

1. Turn the monitor power OFF, and remove the video cable.
2. Check that all controls are preset as shown in steps 3-5 of the cutoff adjustment procedure (over).
3. Connect the video cable, turn the monitor power ON, and let the monitor warm up for 10 minutes. Make sure that the Control Panel is set to 16 shades of gray and is not in the color mode.
4. Display the Gray Bars test pattern.
5. Alternately adjust the background controls (B.BKG, G.BKG, and R.BKG) so that:
 - Bars 1, 2, and 3 have no predominant color
 - Bar 1 is completely black (same as border)
 - Bar 2 and Bar 3 are barely visible and dark gray, respectively, as shown in Figure 2.
6. Adjust the G.DRIVE control on the B board until

the center of bar 8 (the brightest bar) measures at the mid '9' scale on the light meter (see Figure 2).

7. Now adjust the R.DRIVE and B.DRIVE controls until there is no predominant color in the display. You may have to repeat steps 6 and 7.

NOTE: If there is no predominant color, bar 8 measures at mid '9' on the light meter, and bars 1-3 are adjusted as shown in Figure 2, the white balance is correct. If minor adjustments are still required, do steps 8 and 9.

8. Adjust the SUB CONT control until the brightness at the center of bar 8 measures at mid '9' on the light meter.
9. Display the Gray Bars and adjust the SUB BRT so that the 1st bar is completely black and the 2nd bar is barely visible.

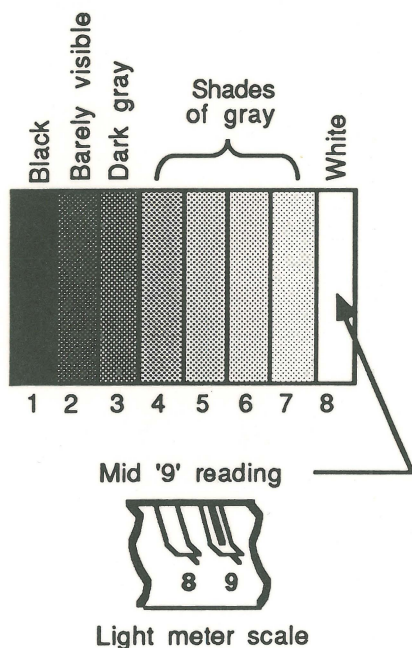


FIGURE 2

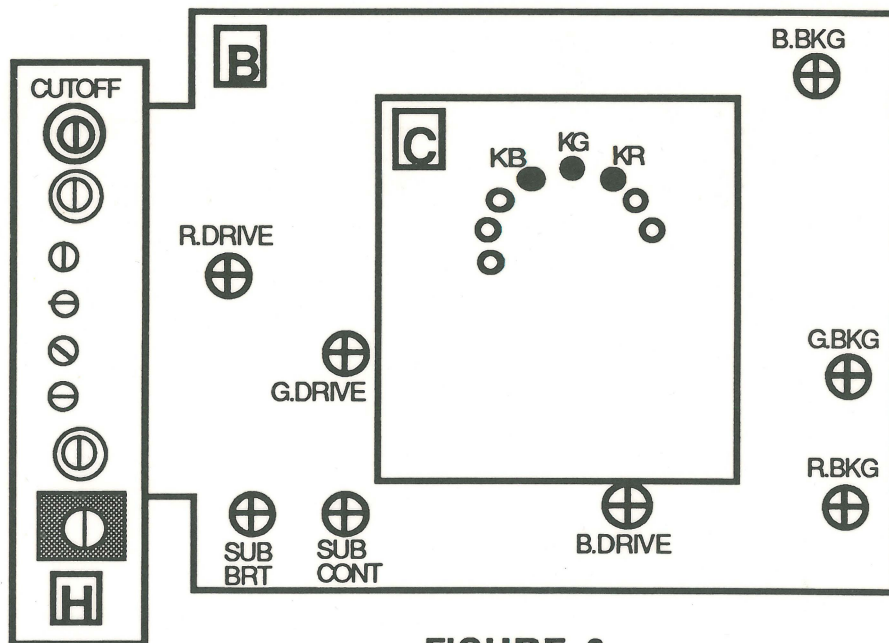


FIGURE 3

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Apple Service Technical Procedures Macintosh Family

Volume Three

PN: 072-0228

🍏 Apple Technical Procedures

Macintosh Family

Volume Three

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High-Res Monochrome Monitor

Technical Procedures

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High-Res Monochrome Monitor

Section 1 – Basics

❑ CONTENTS

1.2 Product Description

□ PRODUCT DESCRIPTION

The Apple® High-Res Monochrome Monitor is a 12-inch monitor that provides a high-resolution black and white display for the Macintosh II. The monitor features 640 x 480 resolution, a universal power supply, and glare protection.

The power switch (Figure 1, #1), contrast control (Figure 1, #2), and brightness control (Figure 1, #3) are the only controls recommended for user access. The LED on the lower-front case indicates when the power is on.

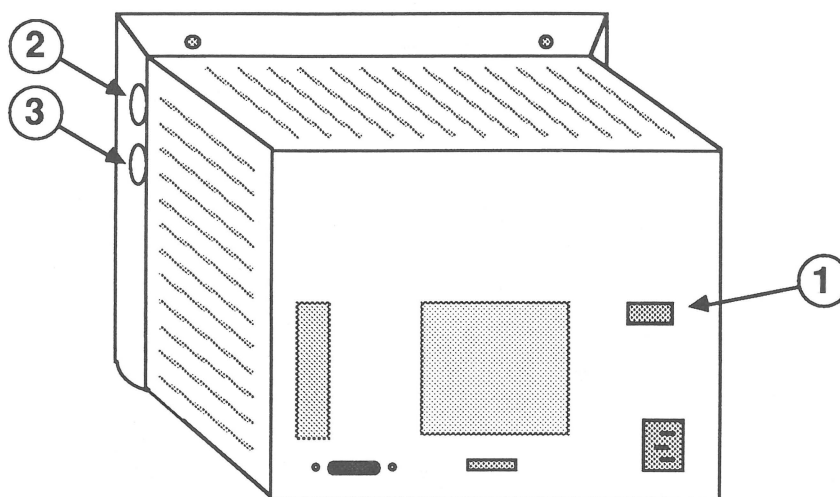


FIGURE 1

The Apple High-Res Monochrome Monitor contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, *CRT Safety*, under the *You Oughta Know* tab.

High-Res Monochrome Monitor

Section 2 – Take-Apart

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- 2.3 Rear Cover
- 2.4 Discharging the Cathode-Ray Tube (CRT)
- 2.5 Anode Cap
- 2.6 Main Logic Board
- 2.10 Power Supply
- 2.12 Fuse
- 2.14 Contrast Control Board
- 2.16 Video Board "C"
- 2.20 Chassis Assembly
- 2.22 Cathode-Ray Tube (CRT)
- 2.24 LED Cable Assembly
- 2.26 Power Switch

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

□ REAR COVER

WARNING: The Apple High-Res Monochrome Monitor contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the rear cover. Failure to follow the safety rules could result in serious injury.

Materials Required

Medium Phillips screwdriver

Remove

1. Turn off the monitor, and disconnect the AC power cord and the video cable from the monitor.
2. Place the monitor face-down on a soft surface to avoid damage to the CRT screen.

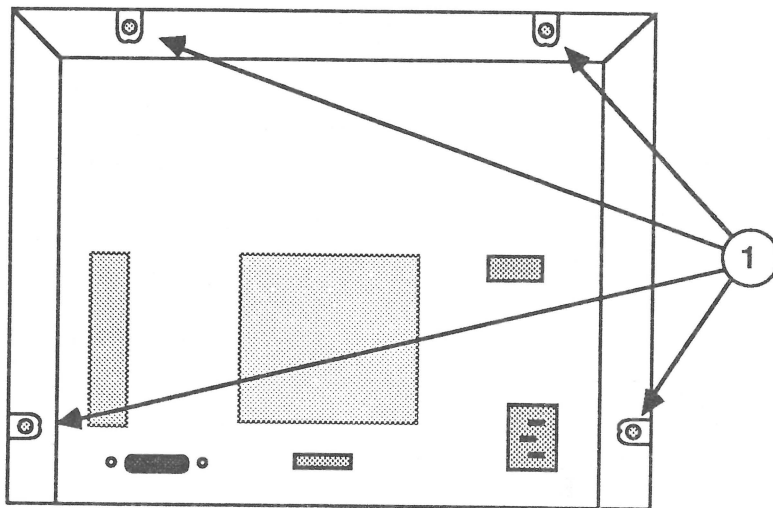


FIGURE 1

3. Remove the four screws (Figure 1, #1) from the rear cover. Lift the rear cover off the CRT bezel.

Replace

1. Slide the rear cover onto the CRT bezel.
2. Replace the four Phillips screws (Figure 1, #1).

□ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The High-Res Monochrome Monitor is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off.

Nevertheless, you must follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number 076-0381)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the You Oughta Know tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are also given in that section.

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**
2. Remove the rear cover, and set the monitor upright with its back facing you.
3. Attach the clip of the CRT discharge tool to any part of the metal chassis that surrounds the back of the CRT (Figure 2, #1).
4. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.

5. Slide the CRT discharge tool under the anode cap (Figure 2, #2) and push it toward the center of the cap until the probe touches the metal anode ring.
6. Remove the CRT discharge tool and disconnect it from the metal chassis.

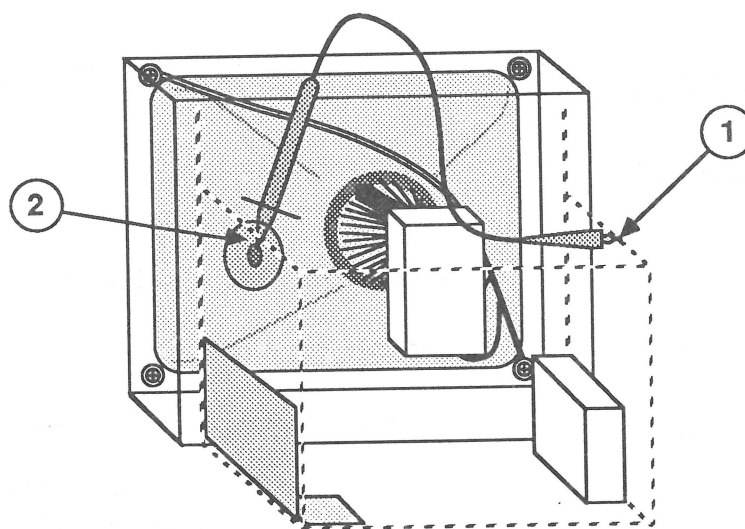


FIGURE 2

Note: A charge can build up even after you have discharged the CRT. If you do not finish within 30 minutes, you should discharge the anode again. Or, to ensure that any residual charge is dissipated during a service procedure, establish a ground by fastening one end of an alligator lead to the metal chassis, and the other end to the anode.

Anode Cap

For some procedures you may have to remove the anode cap. Peel back the cap until you can see the ring (or connector) at the center. Using needlenose pliers, compress the two prongs on the ring to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector and insert it into the aperture. Press the edges of the anode cap down to ensure a firm seal, and tug on the anode wire to make sure it is firmly seated.

□ MAIN LOGIC BOARD

Materials Required

Medium Phillips screwdriver

Remove

To remove the main logic board:

1. Remove the rear cover.
2. Discharge the CRT. Remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

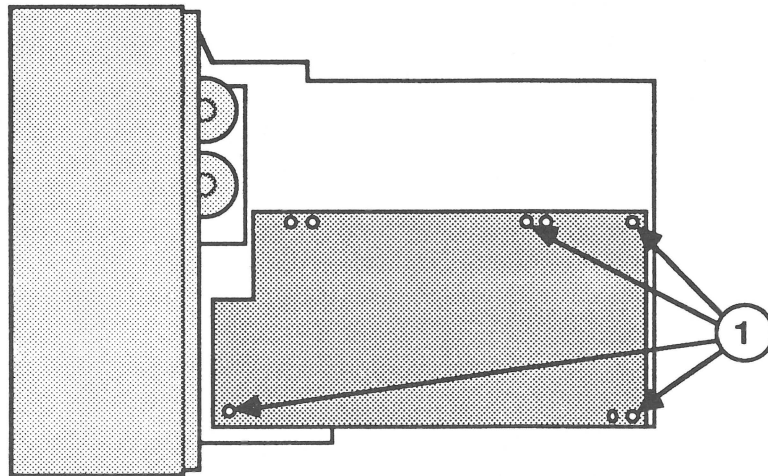


FIGURE 3

4. Remove the four screws that fasten the logic board to the metal chassis frame (Figure 3, #1).

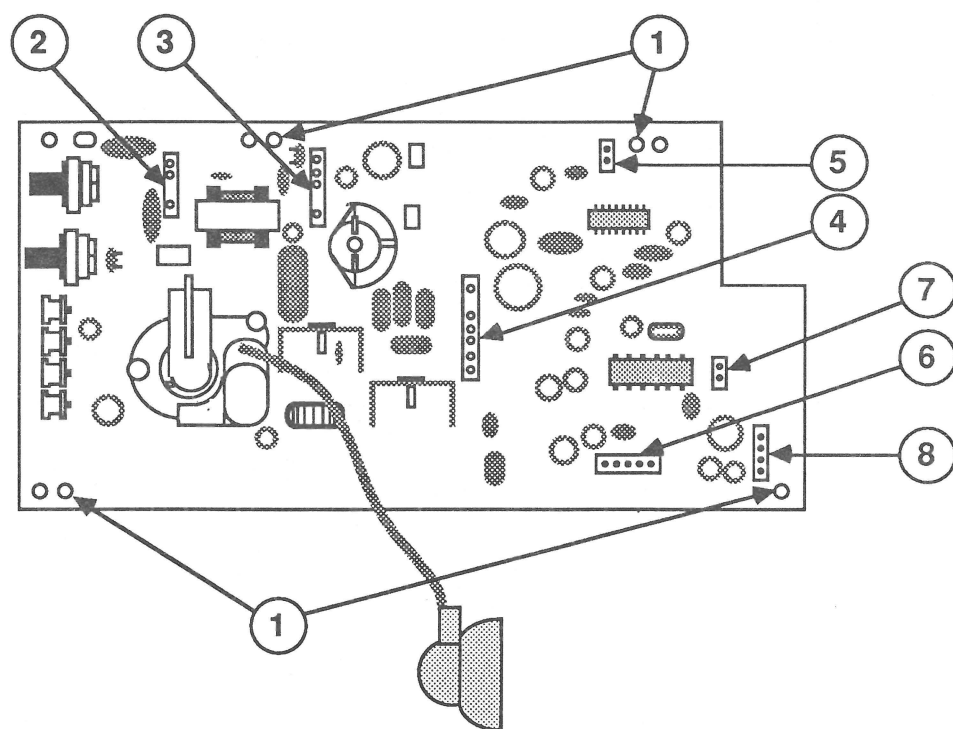


FIGURE 4

5. Remove the anode wire from the plastic cable clamp under the CRT yoke.
6. Remove the following connectors from the inside of the logic board:
 - D-7, the large three-pin connector (Figure 4, #2)
 - D-8, the large four-pin connector (Figure 4, #3)
 - D-6, the large six-pin connector (Figure 4, #4)
 - D-9, the two-pin connector (Figure 4, #5)
 - D-2, the five-pin connector (Figure 4, #6)
 - D-5, the two-pin connector (Figure 4, #7)
 - D-4, the four-pin connector (Figure 4, #8)

Note: The last four connectors are tightly fitted and difficult to reach, so pull the logic board away from the metal chassis before you try to remove them.

7. Lift the main logic board from the metal chassis.

Replace

To replace the main logic board:

1. Pass the anode wire through the flyback arch on the chassis.

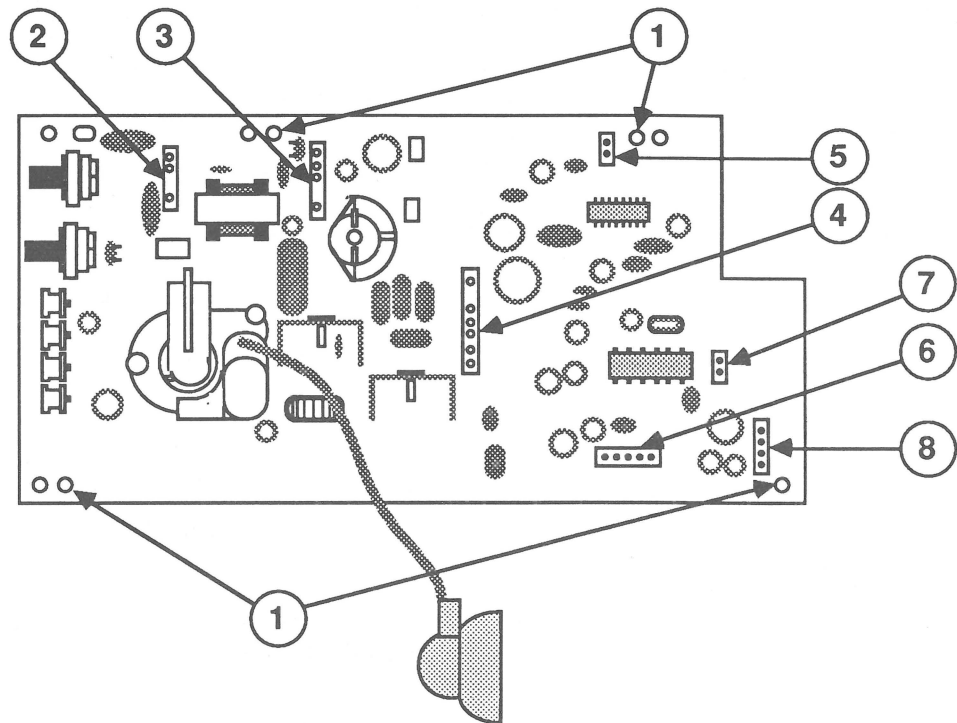


FIGURE 5

2. Starting from the end closest to the CRT, hook the connectors back to the main logic board.
 - D-4, the four-pin connector from the contrast board (Figure 5, #8)
 - D-2, the five-pin connector from the video board "C" (Figure 5, #6)
 - D-5, the two-pin connector from the interface connector (Figure 5, #7)
 - D-9, the two-pin connector from the LED board (Figure 5, #5)
 - D-6, the six-pin connector from the power supply (Figure 5, #6)

- D-8, the four-pin connector from the CRT yoke (Figure 5, #3)
 - D-7, the three-pin connector from the video board "C" (Figure 5, #2)
3. Place the logic board against the metal chassis and align the screw holes. Replace the four screws that hold the main logic board in place (Figure 5, #1).
 4. Route the anode wire through the cable clamp on the bottom of the chassis. Reconnect the anode cap, making sure that both metal clips are hooked in correctly.
 5. Place all loose wires in their plastic cable clamps.
 6. Replace the rear cover.

□ POWER SUPPLY

Materials Required

Medium Phillips screwdriver

Remove

To remove the power supply:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

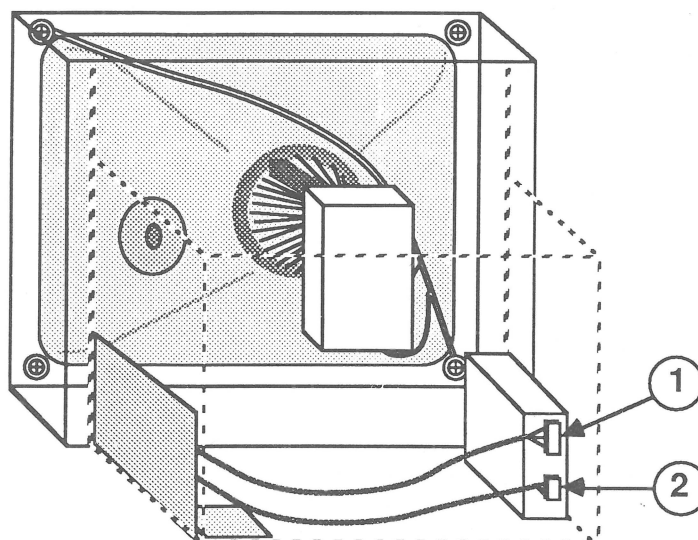


FIGURE 6

4. Unplug the six-pin connector (Figure 6, #1) and the three-pin connector (Figure 6, #2) from the rear of the power supply.

Note: It may be easier to remove the lower connector if you first remove any tie wraps or clamps from the cable. Then lift the chassis with one hand and reach the power supply from underneath with the other hand.

5. Release the CRT ground wire from the plastic cable clamp on the side of the power supply.

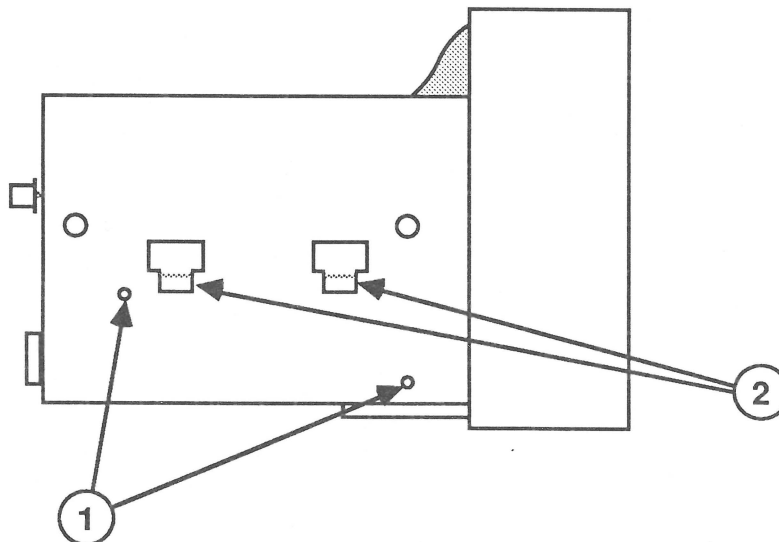


FIGURE 7

6. Unscrew the two screws on the outside of the chassis that hold the power supply in place (Figure 7, #1).
7. Lift the power supply up until the tabs on the side of the power supply (Figure 7, #2) are free of the corresponding chassis holes. Take the power supply out of the monitor and set it aside.

Replace

To replace the power supply:

1. Set the power supply inside the chassis, but don't yet insert the tabs. Reconnect the six-pin connector from the logic board (Figure 6, #1) and the three-pin connector from the power switch (Figure 6, #2) to their connectors on the rear of the power supply.
2. Slide the tabs on the side of the power supply into the holes in the side of the chassis (Figure 7, #2).
3. Replace the two screws that hold the power supply in place. The screw holes in the chassis are indicated by etched arrows (Figure 7, #1).
4. Replace all loose wires in the plastic cable clamps.
5. Replace the back cover.

□ FUSE

Materials Required

Plastic adjustment tool

Remove

To remove the fuses on the power supply:

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the power supply.
4. Remove the two screws on the sides of the power supply housing (Figure 8, #1) and the screw in the indentation on the bottom (Figure 8, #2).
5. Slide the power supply board out of the metal casing and locate the fuse on the upper left corner of the board (Figure 8, #3).
6. If the wire inside the fuse is broken, remove the fuse. Insert a plastic adjustment tool or small plastic screwdriver under one metal end, and gently pry up until you can pull the fuse out with your fingers.

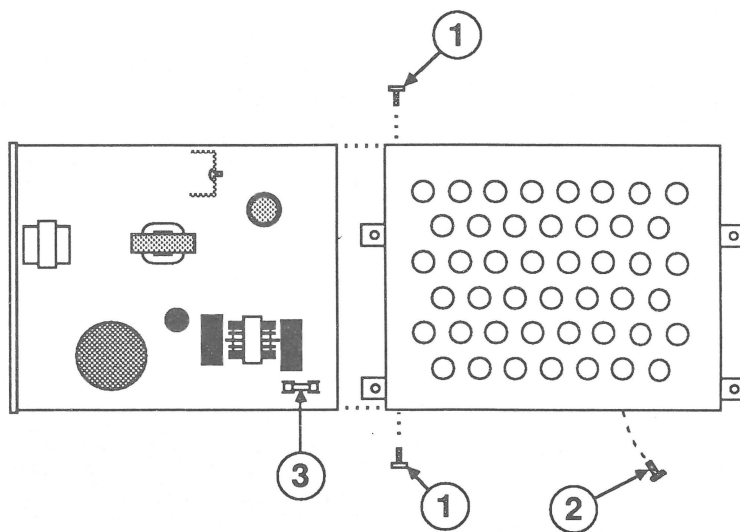


FIGURE 8

Replace

To replace the fuse:

1. Be sure you have the correct fuse (250 v, 2 A).
2. Gently press the fuse into the clamp.
3. Slide the power supply board back into its metal casing.

IMPORTANT: Make sure the power supply board slides into the middle slot on the side of the casing (Figure 9, #1). The board should not touch the bottom of the casing.

4. Replace the two screws on the side of the housing (Figure 8, #1) and the screw in the indentation on the bottom of the housing (Figure 8, #2).
5. Replace the power supply.
6. Replace the rear cover.

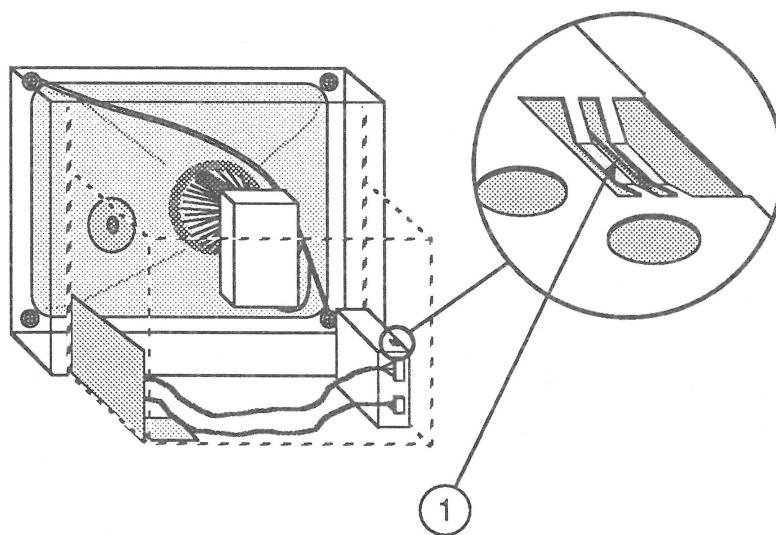


FIGURE 9

□ CONTRAST CONTROL BOARD

Materials Required

Medium Phillips screwdriver

Remove

To remove the contrast control board:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

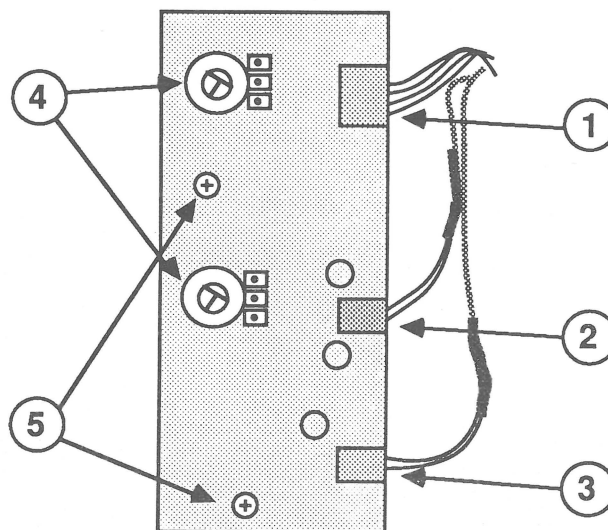


FIGURE 10

4. Remove the wires from the cable clamps. Disconnect the upper (Figure 10, #1), middle (Figure 10, #2), and lower connectors (Figure 10, #3) on the contrast control board.
5. Pull the two knobs off of the board (Figure 10, #4).
6. Remove the two screws holding the board in place (Figure 10, #5).
7. Set the board aside.

Replace

To replace the contrast control board:

1. Position the contrast control board against the chassis so that the two screw holes in the board line up with the corresponding holes in the chassis. Replace the two screws (Figure 10, #5).
2. The contrast control knob stems are keyed so that the knobs will fit in only one position. Look at the inside of the knobs and align them with the knob stems. Slide the knobs onto the stems (Figure 10, #4).
3. Reconnect the four-pin connector from the logic board (Figure 10, #1), the two-pin connector from the video board "C" (Figure 10, #2), and the two-pin connector from the interface connector (Figure 10, #3).
4. Replace the rear cover.

□ VIDEO BOARD "C"

Materials Required

Medium Phillips screwdriver

Remove

To remove the video board "C" and its cables:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)

Note: The video board "C" is enclosed in a metal box. When replacing the video board "C," **keep the back cover of the metal box** and send the rest of the module, including the cables, back to Apple.

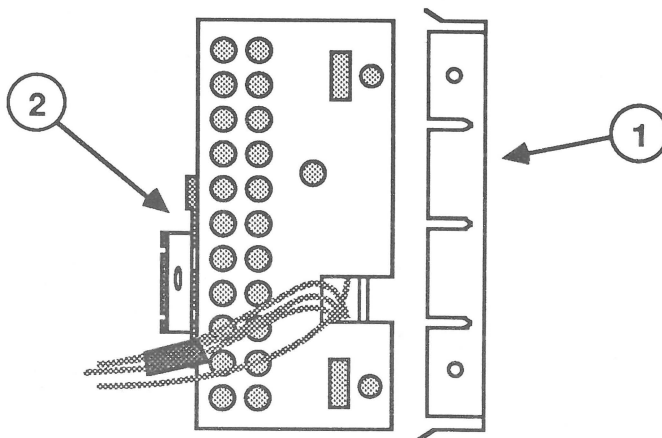


FIGURE 11

4. Pull off and set aside the back of the metal box that holds the video board "C" (Figure 11, #1).

5. Remove the cables from the plastic cable clamps. Disconnect the following connectors from the logic board:

- D2, from the right side of video board "C" (Figure 12, #1).
- D7, from the left side of video board "C" (Figure 12, #3).

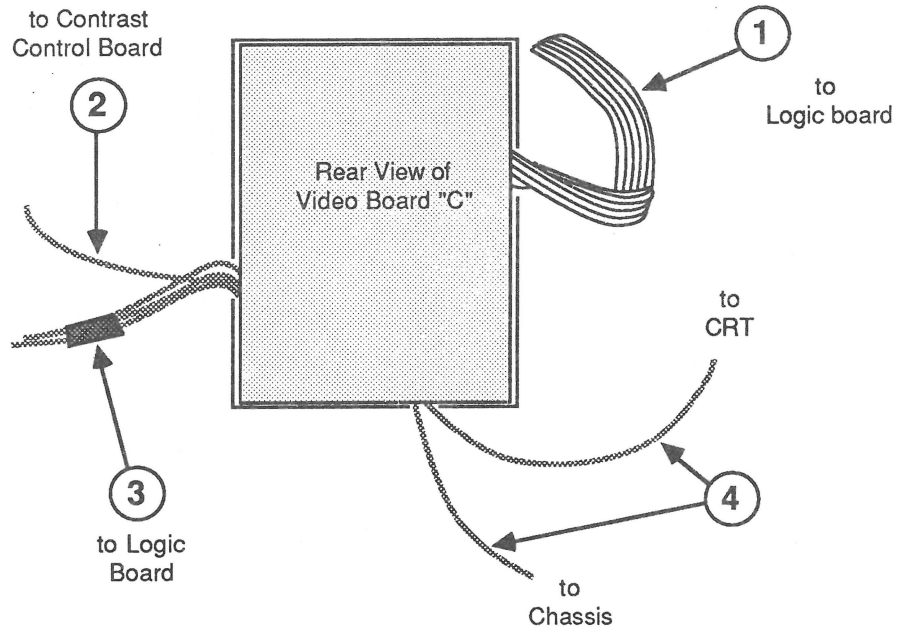


FIGURE 12

6. Disconnect the cable at location V-5 on the contrast control board (Figure 12, #2).
7. Disconnect the two black cables from the bottom of video board "C" at their midpoint connectors (Figure 12, #4).
8. Carefully support the neck of the CRT by holding the video board from underneath. Then loosen the metal clamp that holds video board "C" to the CRT neck by loosening the screw part way (Figure 11, #2).

WARNING: If the tape under the metal clamp is sticky and difficult to loosen, ***very carefully*** cut away the tape using an exacto knife. ***Do not put pressure on the neck of the CRT!***

9. Carefully pull video board "C" off the CRT neck.

Replace

To replace the video board "C":

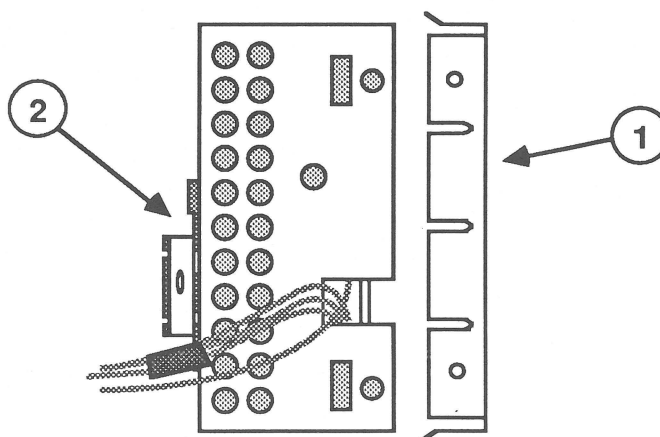


FIGURE 13

1. Replace the back cover (Figure 13, #1) on the video board "C."
2. Slide the video board "C" onto the CRT neck. Tighten the screw (Figure 13, #2) on the ring clamp just enough to keep the assembly from slipping.

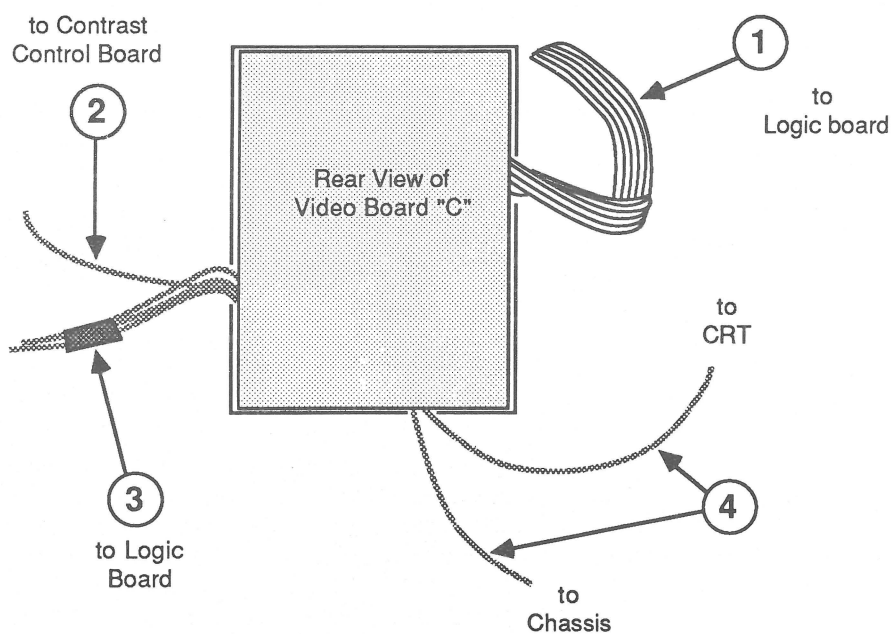


FIGURE 14

3. Reconnect the two black wires from the bottom of the video board "C" at their midpoint connectors (Figure 14, #4). The short wire goes to the chassis and the long wire goes to the CRT.
4. Reconnect the following connectors to the logic board:
 - D-2, from the left side of the logic board (Figure 14, #3).
 - D-7, from the right side of the logic board (Figure 14, #1).
5. Plug the two-pin connector (Figure 14, #2) into the contrast control board at location V-5.
6. Replace all loose cables in the plastic cable clamps.
7. Replace the rear cover.

□ CHASSIS ASSEMBLY

Materials Required

Long-handled medium Phillips screwdriver

Remove

To remove the chassis assembly:

1. Remove the rear cover.
2. Discharge the CRT. Disconnect the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the video board "C."

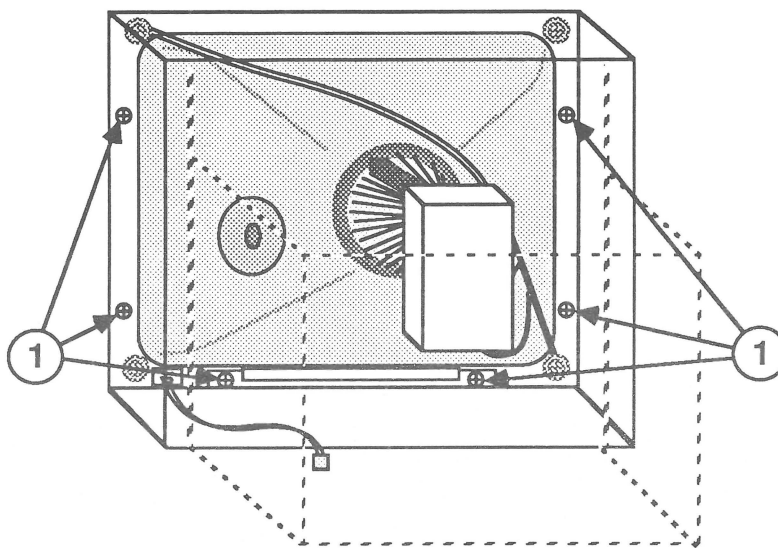


FIGURE 15

5. Remove the two-pin connector at location D-9 on the logic board.
6. Remove the six screws holding the chassis in place (Figure 15, #1).
7. Pull the chassis off the bezel.

Replace

To replace the chassis:

1. If you have removed the power supply and the logic board, replace them on the metal chassis frame.
2. Slide the chassis into the front bezel. Make sure the front of the chassis slides all the way inside the bezel at top, sides, and bottom.
3. Replace the six chassis screws (Figure 15, #1).

Note: The two screws on the bottom of the chassis have small alignment holes next to them. Make sure the corresponding plastic bumps on the bezel are aligned with these holes before you tighten the screws.

4. Replace the video board "C."
5. Replace the anode cap.
6. Replace the rear cover.

□ CATHODE RAY TUBE (CRT)

Materials Required

Long-handled medium Phillips screwdriver

Remove

To remove the CRT:

1. Remove the rear cover.
2. Discharge the CRT. Disconnect the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the video board "C."
5. Remove the connector at location D-9 on the logic board.
6. Remove the chassis assembly.

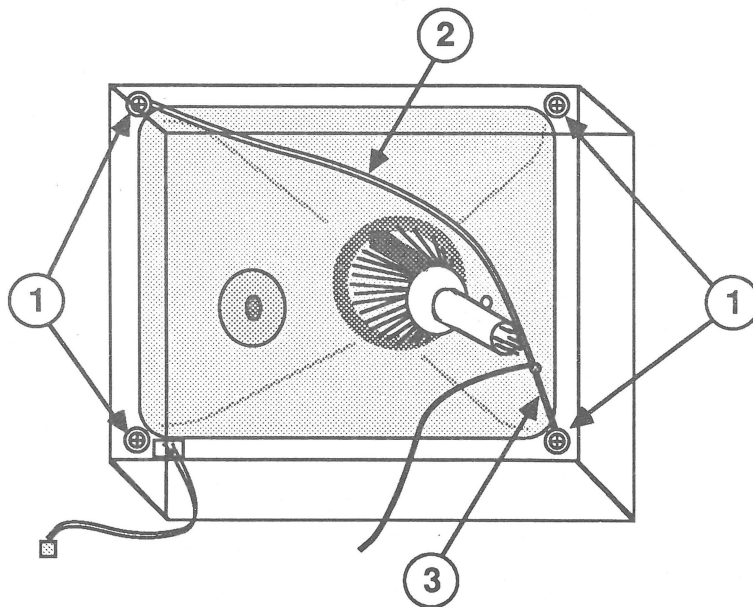


FIGURE 16

7. Remove the four mounting screws from the corners of the CRT (Figure 16, #1).
8. Carefully grasp the sides of the CRT (not the neck), and lift the CRT out of the bezel.
9. Remove the grounding strap (Figure 16, #2) and the spring (Figure 16, #3). Save them to use on your replacement CRT.

WARNING: *If you need to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the You Oughta Know tab.*

Replace

To replace the CRT:

1. Place the bezel face-down on a clean, soft surface.
2. Loop the grounding strap (Figure 16, #2) over the top-left screw bracket, and attach the spring (Figure 16, #3) to the bottom-right screw bracket on the CRT.
3. Carefully set the CRT inside the bezel.
4. Replace the four mounting screws in the corners (Figure 16, #1). The washers go on the corners that have the attached grounding strap and spring.
5. Replace the chassis assembly.
6. Replace the connector at location D-9 on the logic board. Replace the cable in the plastic cable clamps.
7. Replace video board "C."
8. Replace the anode cap.
9. Replace the rear cover.

□ LED CABLE ASSEMBLY

Materials Required

Long-handled medium Phillips screwdriver (magnetic)
Needlenose pliers

Remove

To remove the LED cable assembly:

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Disconnect the connector at location D-9 on the logic board. Remove the cable from the cable clamps.
5. Place the monitor face down on the grounded workbench pad.

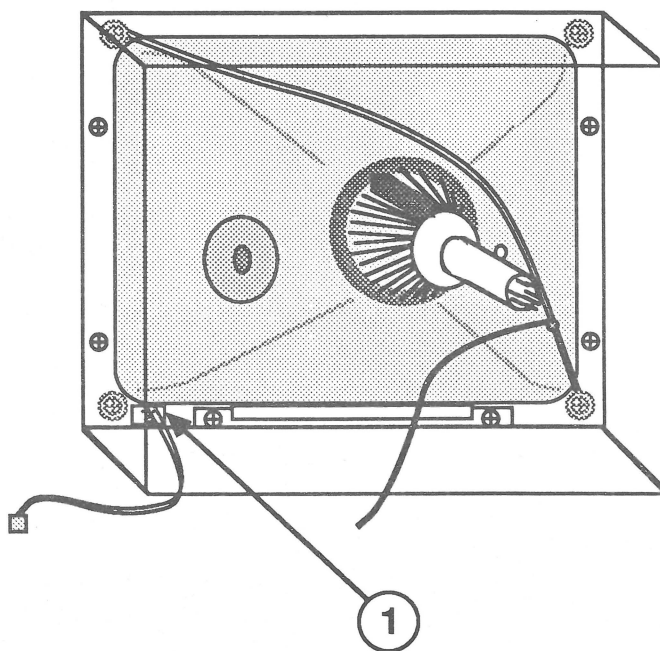


FIGURE 17

6. Remove the screw that holds the LED board in the lower left corner of the bezel (Figure 17, #1).
7. Lift the LED assembly free.

Replace

To replace the LED cable assembly:

1. Place the monitor face down. Holding the LED cable, lower the LED board through the corner space between the metal chassis and the CRT.
2. Replace the screw that holds the LED board in place on its plastic mounting. Be sure to line up the plastic alignment bump with the corresponding hole in the LED board.
3. Replace the connector at location D-9 on the logic board. Replace the cable in the plastic cable clamps.
4. Replace the rear cover.

□ POWER SWITCH

Materials Required

Medium Phillips screwdriver
Soldering tools

Remove

To remove the power switch:

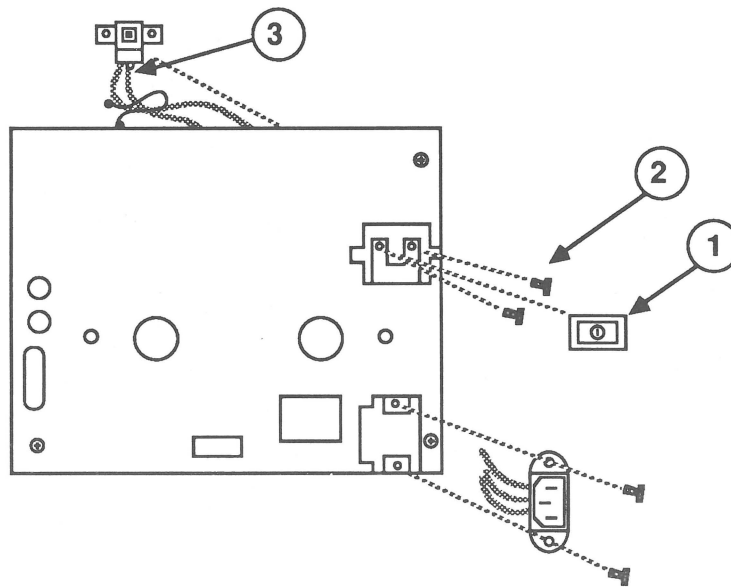


FIGURE 18

1. Pull the plastic knob off the power switch stem (Figure 18, #1).
2. Remove from the metal bracket the two screws that hold the switch (Figure 18, #2) .
3. Remove the two wires (Figure 18, #3) from the plastic cable clamp and desolder the wires from the switch.

Replace

To replace the power switch:

1. Solder the two wires to the switch (Figure 18, #3).
2. Replace the plastic cable clamp. Replace the switch in its metal bracket, lining up the screw holes.
3. Replace the two screws (Figure 18, #2).
4. Push the button on the switch stem (Figure 18, #1).

High-Res Monochrome Monitor

Section 3 – Adjustments

□ CONTENTS

3.2	Introduction
3.3	Safety Instructions
3.4	MacTest II/IIx Test Patterns
3.4	Introduction
3.4	Materials Required
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3.6	Introduction
3.6	Horizontal Size (Width)
3.7	Vertical Size (Height)
3.7	Focus
3.8	Cutoff
3.11	MacTest IIcx/IIci Test Patterns
3.11	Materials Required
3.11	Generating the Test Patterns

□ INTRODUCTION

After you replace any module in the system you are working on, you should check the text and graphics production of the CRT. Use any text and graphics software program for the evaluation.

Do Not Adjust the Yoke

All yoke adjustments have been set by the manufacturer. Do not attempt to make any tilt, ring, or geometric adjustments on the High-Res Monochrome Monitor. If the customer's monitor has adjustment problems that the following procedures do not correct, isolate the faulty module (see Troubleshooting) and return it to Apple for repair.

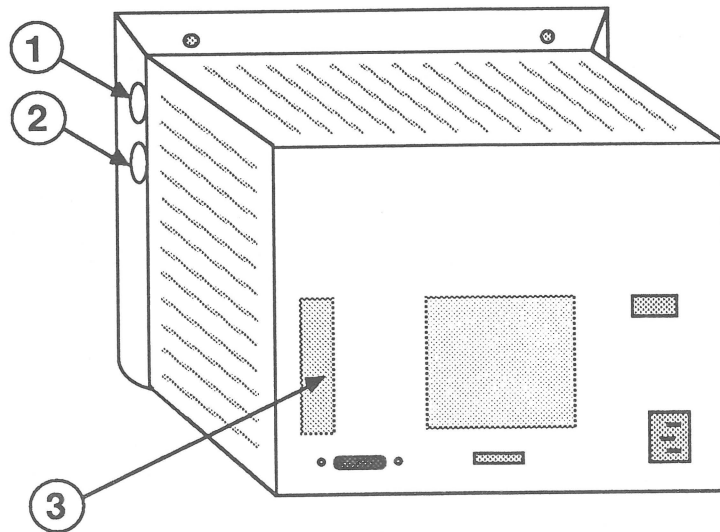


FIGURE 1

Location of Controls

The brightness control (Figure 1, #1) and the contrast control (Figure 1, #2) are located on the side of the monitor for access by the customer. All other adjustment controls are located under a rear panel (Figure 1, #3) for dealer access:

- Focus (Figure 2, #1)
- Cutoff (Figure 2, #2)
- Vertical size or height (Figure 2, #3)
- Horizontal size or width (Figure 2, #6)

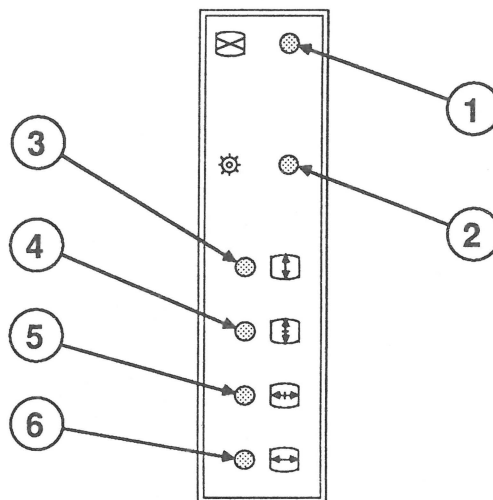


FIGURE 2

The vertical hold (Figure 2, #4) and horizontal hold (Figure 2, #5) adjustments are set at the factory and normally do not need adjusting.

□ SAFETY INSTRUCTIONS

1. Use only a three-pronged, grounded electrical outlet installed by a qualified electrician, and **do not under any circumstances use an adapter plug.**
2. Do not attempt to make any adjustments on the monitor other than those explained in this section, and do those with extreme caution.
3. Read and follow the "Safety Precautions" in the Basics section.

□ MACTEST II/Ix TEST PATTERNS

Introduction

MacTest™ II/Ix is designed to run from a Macintosh II or Macintosh IIfx computer. To test a High-Res Monochrome Monitor from a Macintosh IIfx or Macintosh IIfx, refer to "MacTest IIfx/IIfx Test Patterns" later in this section.


The *MacTest II/Ix* diagnostic program tests the video RAM on the video card and displays test patterns to help you adjust the monitor. *MacTest II/Ix* does not diagnose monitor problems; to diagnose monitor problems, read the Troubleshooting section.

Materials Required

Plastic flat-blade screwdriver (tweaker)
Plastic flat-blade screwdriver, cut to two-inch length
Macintosh II or Macintosh IIfx
Macintosh Monochrome Video Card
MacTest II/Ix diagnostic disk (version 3.1 or higher)
Light meter (Sekonic Multi-Lumi, model L-248)
Medium Phillips screwdriver

Generating the Test Patterns

Follow the steps below to test the video RAM and display the monitor test patterns.

1. Insert the *MacTest II/Ix* disk in the right-side drive and turn on the power.
2. Unless you wish to test the Macintosh II or IIfx logic board at this time, click **OK** to ignore the message that says you must connect a SCSI loopback cable.
3. When the Start window appears on the screen, go to the  menu and open the Control Panel.
4. Click the Monitors icon.
5. In the box called **Grays** (it may be called **Colors**, if Colors is selected), select **16** (or the highest number available).
6. Check the monitor icons at the bottom of the panel. If necessary, drag the menu bar to the icon of the monitor being tested to make it the main monitor.
7. Close the Control Panel.

Note: If you selected a new main monitor, you must reboot *MacTest II/Ix* for this change to take effect.

8. Select **Test Selections** from the **Options** menu.
When the **Test Selections** window appears, deselect the default **Logic** and **Disk Drives** tests by clicking their selection boxes once.
9. If you want to test video RAM on the video card, click the box for **Video Card in slot**.
10. Click the **Video monitor** box to display the video adjustment test patterns, and click **OK** to close the **Test Selections** window.
11. When the **Start** window reappears, click the **Start** button.

Note: If you selected the video card RAM test, this message will appear: **Testing Macintosh Video Card**. Horizontal and vertical lines will flash across the screen. After about one minute the **Start** window will reappear, and the **Status** line will indicate whether the video card has passed or failed the test.

12. *MacTest II/Ix* will display a window telling you how to change the main monitor (if necessary). Click **OK** to display the first test pattern.

Note: Click the mouse to advance to the test pattern you want. Each test pattern is displayed once. When you have advanced through the test patterns, you will be returned to the **Start** window. To redisplay the test patterns, click the **Start** button.

13. *MacTest II/Ix* displays the following test patterns:
 - Gray Bars
 - Full White Screen
 - Full Black Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

□ ADJUSTMENT PROCEDURES

Introduction

For all of the following adjustments, set the CONTRAST knob (Figure 3, #2) on maximum (turn clockwise) and the BRIGHTNESS knob (Figure 3, #1) on the center click position.

To find the center click position on the BRIGHTNESS knob, turn the knob up as far as it will go, and then turn the knob down as far as it will go. The place in the middle where the knob hesitates is the center click.

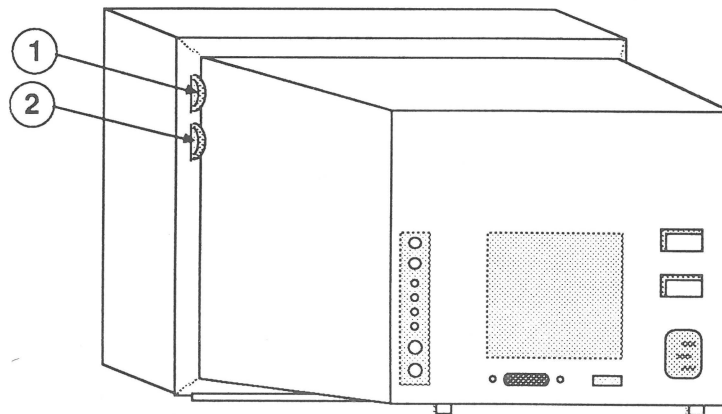


FIGURE 3

Horizontal Size (Width)

To make the horizontal adjustment:

1. Display the **Crosshatch II (white background)** test pattern on the monitor (see "Setup"). Be sure the CONTRAST knob is set at maximum and the BRIGHTNESS knob is set at the center click position, as directed above.
2. Insert the plastic screwdriver in the HORIZONTAL SIZE control (Figure 4, #1) and twist it until the raster is 213.5 mm wide.

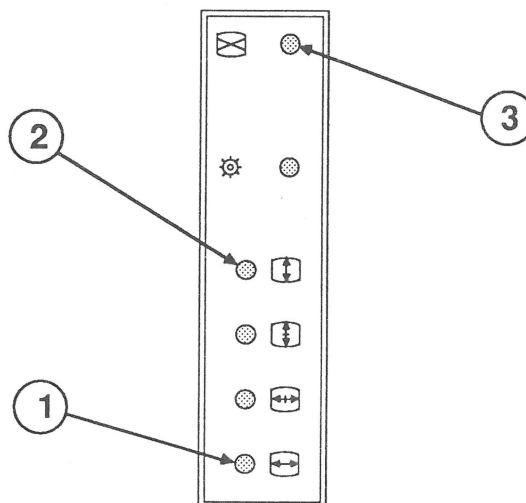


FIGURE 4

IMPORTANT: Always adjust the horizontal size before you adjust the vertical size. The horizontal adjustment can affect the height of the raster.

Vertical Size (Height)

After you have adjusted the horizontal size, you can adjust the vertical size:

1. Display the **Crosshatch II (white background)** test pattern on the monitor (see "Setup").
2. Insert the plastic screwdriver in the VERTICAL SIZE control (Figure 4, #2) and twist it until the raster is 160 mm high.

Focus

1. Display the **Focus** test pattern on the monitor (see "Setup"). Be sure the CONTRAST knob is set at maximum and the BRIGHTNESS knob is set at the center click position.
2. Insert the plastic screwdriver in the FOCUS control (Figure 4, #3) and adjust the focus for the best clarity at the center of the screen.

Cutoff

The following cutoff and subcontrast adjustments should only be performed if the main logic board, contrast control board, or video board has been replaced.

1. Remove the rear cover of the monitor (see Section 2, Take-Apart).
2. Set the monitor upright, and connect its video cable and AC power cord.
3. Locate the SUBCONTRAST control (Figure 5, #1) on the side of the video board case. Using the two-inch plastic screwdriver, set the SUBCONTRAST control midway between its high and low stops.

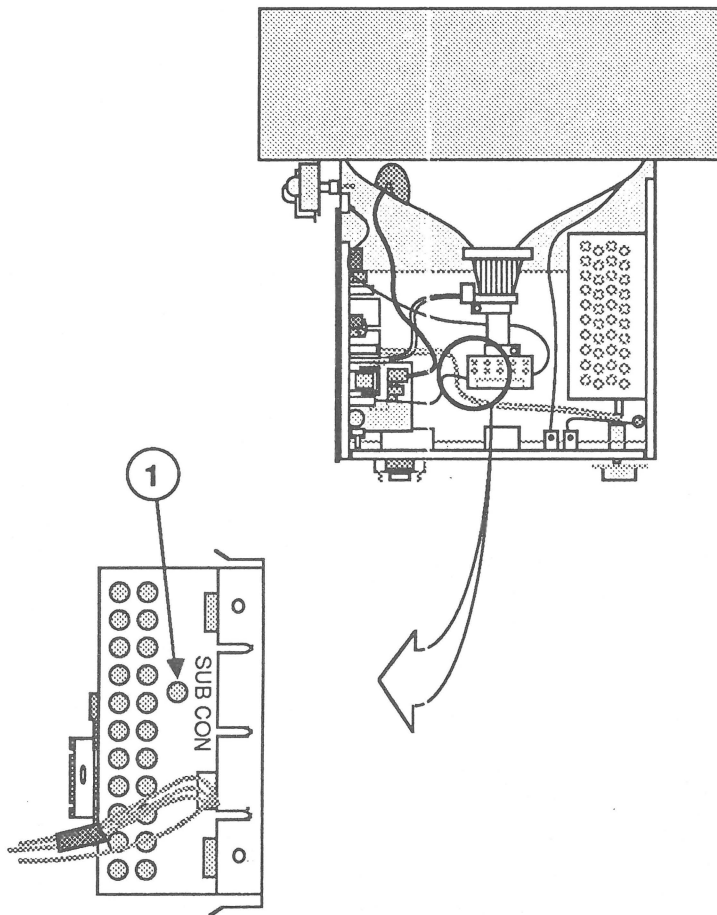


FIGURE 5

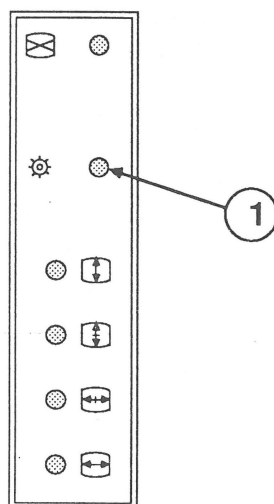


FIGURE 6

4. Display the **Gray Bars** test pattern on the monitor (see "Setup"), and be sure the **Control Panel** is set to **16 Grays**. Also make sure the CONTRAST knob is set at maximum and the BRIGHTNESS knob is set at the center click position.

Note: If the CUTOFF control is turned up (clockwise) too far, the monitor may shut down. If this happens, turn the monitor off and the CUTOFF control all the way down (counterclockwise), and wait 30 seconds. Then turn on the monitor and resume the adjustment.

5. Using the plastic screwdriver, adjust the CUTOFF control (RV506) (Figure 6, #1) until the first bar from the left is black and the second bar is just visible.
6. Display the **Full White Screen** test pattern (see "Setup").
7. Using the light meter and the two-inch plastic screwdriver, adjust the SUBCONTRAST control (Figure 5, #1) until the light meter reads in the middle of the "10" scale (33 ft lamberts).

Use the light meter as follows:

- a) First, to ensure that the light meter is functioning correctly, press the red button on the back of the unit. If the reading is out of the red area, replace the battery.
- b) Move the side switch (Figure 7, #1) to its lower position so that the lower scale (Figure 7, #2) reads 2 through 10.
- c) Uncover the lens of the meter (Figure 7, #3). Place the lens against the middle of the screen and press the "read" button (Figure 7, #4). Take the light meter reading by checking the position of the needle (Figure 7, #5) on the lower scale.

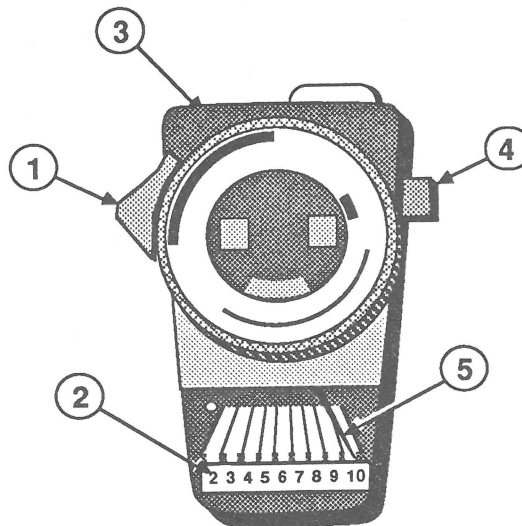


FIGURE 7

□ MACTEST IIcx/IIci TEST PATTERNS

MacTest™ IIcx/IIci tests the video RAM on video cards installed in Macintosh IIcx or IIci computers, and also displays the test patterns used to adjust the High-Res Monochrome Monitor.

Materials Required

Macintosh IIcx or Macintosh IIci
Macintosh II Monochrome Video Card, Macintosh II Video Card, or Macintosh II High-Res Video Card (no video card is required for the Macintosh IIci)
MacTest IIcx/IIci diagnostic disk (version 2.0 or higher)

Generating the Test Patterns

Follow the steps below to test the video RAM and display the monitor test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh IIcx or Macintosh IIci computer.
2. Boot the *MacTest IIcx/IIci* disk.
3. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect all default test selections.

Note: Apple recommends testing the video RAM before performing the video adjustments. To test video RAM on board a Macintosh IIci computer, you must run the **Short** or **Long RAM** logic test.

4. To test the video RAM on an installed video card, click **Video Card in Slot** and enter the appropriate slot number.
5. To display the video adjustment test patterns:
 - Click **Video Monitor Connected to Built-in Video**, or
 - Click **Video Monitor Connected to Selected Card**. (Be sure that the correct video card slot is entered in the Video Card in Slot box.)
6. Click **OK** to close the Test Selections window and return to the Start window.

Note: If built-in video is being used to generate the monitor test patterns, the memory allocation for the built-in video must be set to at least 16 grays/colors. From the Apple menu, open the Control Panel, click **Monitors**, click the highest number of Colors/Grays, and close the Control Panel.

7. From the **Start** window, click **Start** to proceed. You will encounter one or both of these scenarios:
 - If you chose to test the video card, the following message will appear on the main (boot) monitor: **Testing Macintosh II Monochrome Video Card** (or **Testing Macintosh II Video Card** or **Testing Macintosh II High-Res Video Card**). Horizontal and vertical lines will flash across the screen of the High-Res Monochrome Monitor. After about one minute, the Status line in the Start window on the main monitor will indicate whether the video card has passed or failed the test. Clicking **Start** again will display the first test pattern (if selected) or rerun the video card test.
 - If you chose to display only the monitor test patterns, the first (gray bars) test pattern will be displayed on the High-Res Monochrome Monitor. Click the mouse to advance through the test patterns (each test pattern is displayed once). When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)
8. *MacTest IIcx/IIci* displays these test patterns:
 - Gray Bars
 - Color Bars (will appear half black, half white)
 - Full White Screen
 - Full Black Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

Note: If the monitor is connected to a Macintosh II Monochrome Video Card, *MacTest IIcx/IIci* will not display the Gray Bars and Color Bars test patterns.

High-Res Monochrome Monitor

Section 4 – Troubleshooting

❑ CONTENTS

- 4.2 Introduction
- 4.2 Symptom Chart

□ INTRODUCTION

This section contains a symptom chart for the High-Res Monochrome Monitor showing common problems and their solutions. Find the best description of the symptom(s) your defective monitor is displaying; then try the recommended actions in the order listed.

If the first corrective action does not solve the problem, put back the original module or part before you try the next action.

□ SYMPTOM CHART

*No power
(LED does not light)*

1. Check the internal power connectors.
2. Check fuse; replace if blown. If it blows again, go to the next step.
3. Replace power supply.
4. Replace power switch.

No raster

1. Adjust the brightness and contrast knobs.
2. Adjust the sub-brightness (cut-off) control.
3. Make sure the logic board is connected to the power supply.
4. Check fuse; replace if blown. If it blows again, go to the next step.
5. Replace the power supply.
6. Replace the logic board.
7. Replace the power switch assembly.
8. Replace the video board "C."
9. Replace the contrast control board.
10. Replace the CRT.

*One horizontal
line appears
on screen*

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

One vertical raster line appears

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

Raster not rectangular

1. Ensure that all connectors are plugged in correctly.
2. Replace the logic board.
3. Replace the power supply.
4. Replace the CRT assembly.

Raster stretched or compressed on side of screen

- Replace the logic board.

Raster stretched or compressed at top of screen

- Replace the logic board.

Picture breaks in diagonal lines

1. Adjust horizontal hold.
2. Replace the logic board.
3. Replace the power supply.

Raster size small, picture abnormally bright

1. Ensure that the yoke connectors are tight.
2. Replace the logic board.
3. Replace the CRT.

Picture rolls vertically

1. Adjust vertical hold.
2. Check the connector on the I/O connector board.
3. Replace the logic board.

Raster not centered

1. Adjust the horizontal hold.
2. Replace the logic board.
3. Replace the CRT.

Brightness cannot be adjusted

1. Replace the contrast control board.
2. Replace the logic board.
3. Replace video board "C."
4. Replace the CRT.

Picture jitters

1. Confirm that the grounding cables are attached to the chassis.
2. Confirm that the computer is grounded correctly.
3. Replace the power supply.
4. Replace the logic board.

Black spots on screen (burnt phosphor)

- Replace the CRT.

Image is too dark or too bright

1. Adjust the brightness knob.
2. Adjust the sub-brightness (cut-off) control.
3. Replace the logic board.
4. Replace video board "C."
5. Replace the CRT.

Focus cannot be adjusted

1. Replace the logic board.
2. Replace the video board.
3. Replace the CRT.

Flashing lines on screen

1. Confirm the contact of the video connector.
2. Replace the contrast control board.

Raster higher on one side than the other.

1. Replace the logic board.
2. Replace the CRT.

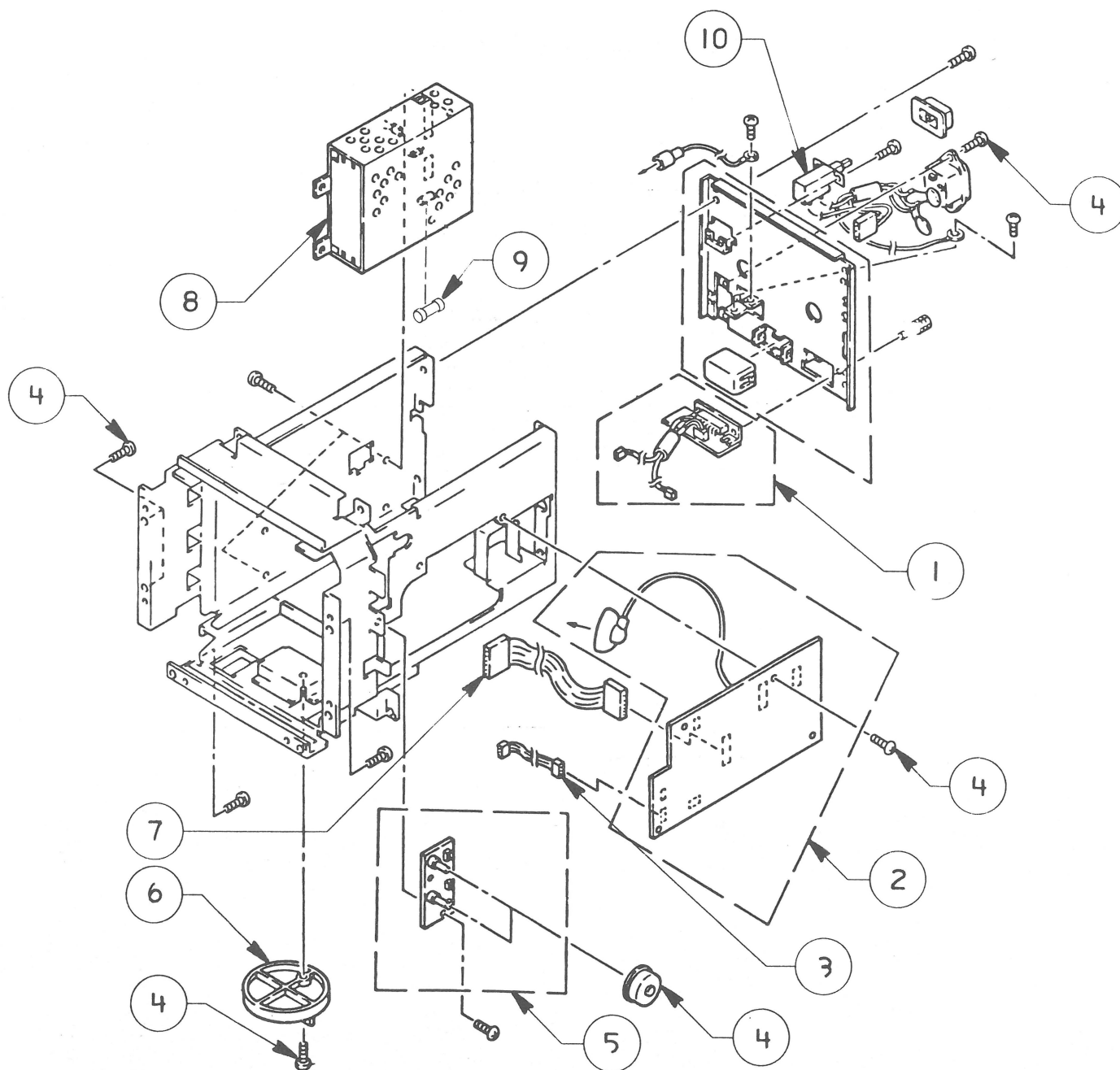
High-Res Monochrome Monitor

Illustrated Parts List

❑ CONTENTS

- IPL.3 Internal Assembly (Figure 1)
- IPL.5 CRT Case Assembly (Figure 2)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple High-Res Monochrome Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.



□ INTERNAL ASSEMBLY (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	933-0014	I/O Connector Board
2	661-0396	Main Logic Board (D)
3	590-0442	Cable, Logic Board to Control Panel
4	956-0007	Screw/Knob Set
5	905-0004	Contrast Control Board
6	949-0118	Stand Attachment, Plastic Bottom
7	590-0441	Cable, Logic Board to Power Supply
8	661-0395	Power Supply
9	740-0305	Fuse, 250 v, 2 amp
10	937-0025	On/Off Switch

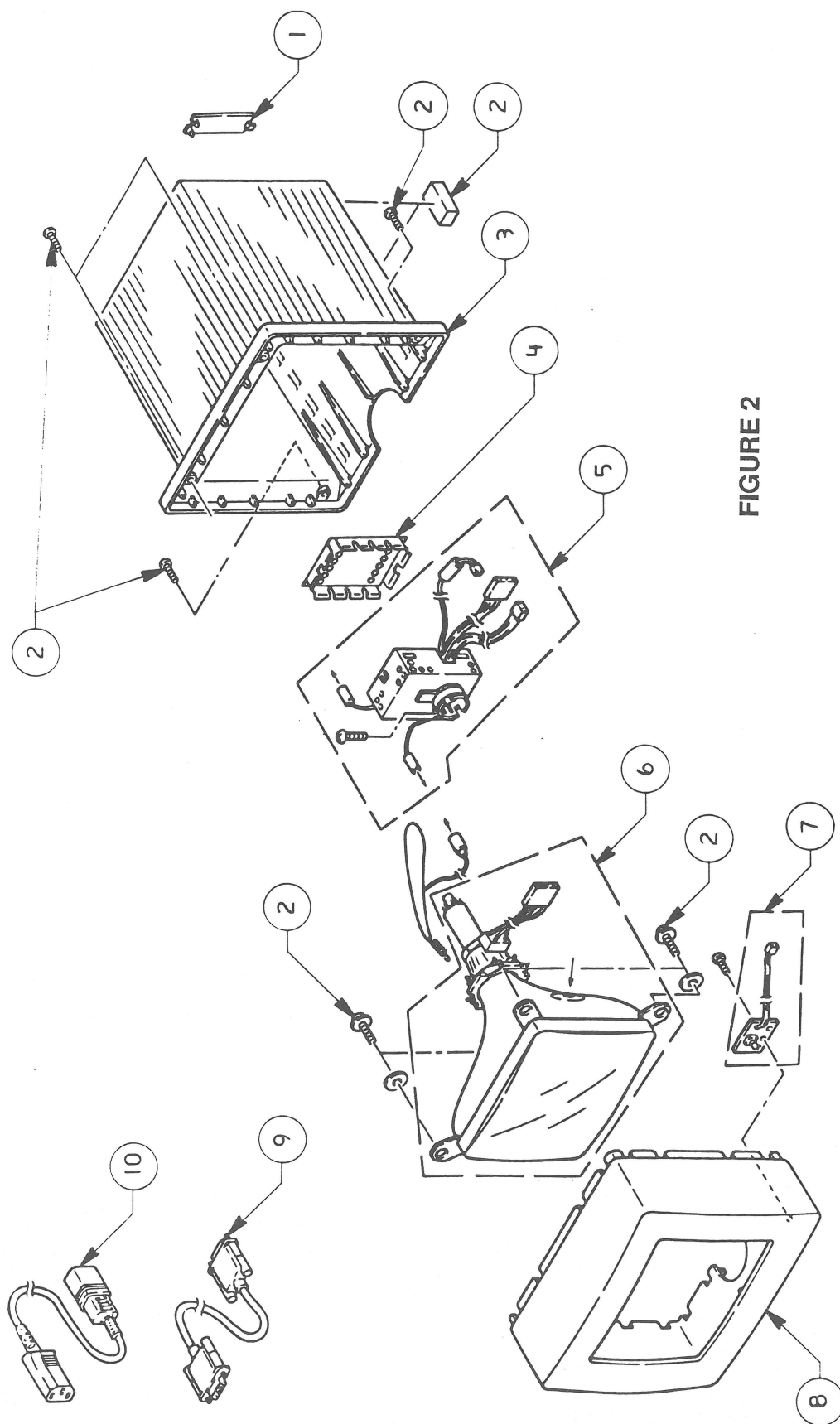


FIGURE 2

□ CRT CASE ASSEMBLY (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	949-0119	Adjustment Panel Cover
2	956-0007	Screw Knob Set
3	949-0117	Rear Cover, Plastic
4	948-0031	Video Board "C" Case Cover
5	981-0007	Video Board "C" with Cable
6	076-0246	CRT Assembly
7	590-0440	LED Cable Assembly
8	949-0116	Bezel, Plastic Case
9	590-4161	Cable, CPU to Monitor, 1.75 M
10	590-0372	Cable, External Power, Domestic, 1.75 M
	590-0422	Cable, External Power, Europe

AppleColor High-Res RGB Monitor

Technical Procedures

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	2.5	Discharge Procedure
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	2.11	Video Color Board Assembly
	2.15	Main Logic Board "D"
	2.21	Power Supply
	2.23	Fuses
	2.26	On/Off Switch
	2.28	Degauss Switch
	2.30	Contrast Control Board "J"
	2.32	High-Voltage Capacitor
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**Section 3 –
Adjustments
(continued)**

- 3.8 Focus
- 3.9 Cutoff
- 3.12 White Balance
- 3.15 Convergence
- 3.19 Geometric Distortion
- 3.23 Jitter Correction
- 3.24 Materials Required
- 3.24 Capacitor Installation
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- 3.28 MacTest IICx/IICi Test Patterns
- 3.28 Materials Required
- 3.28 Generating the Test Patterns

**Section 4 –
Troubleshooting**

- 4.2 Introduction
- 4.2 Monitor Inspection
- 4.3 Symptom Chart

**Illustrated
Parts List**

- IPL.3 CRT Assembly (Figure 1)
- IPL.5 Internal Assembly (Figure 2)

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AppleColor High-Res RGB Monitor

Section 1 – Basics

□ CONTENTS

- 1.2 Product Description
- 1.4 Care and Handling

□ PRODUCT DESCRIPTION

The AppleColor™ High-Res RGB Monitor is a 13-inch full analog RGB video system that has the capacity to display color graphics and text simultaneously. The monitor receives individual red, green, and blue video input and synchronization signals from the Macintosh II through a video card connection.

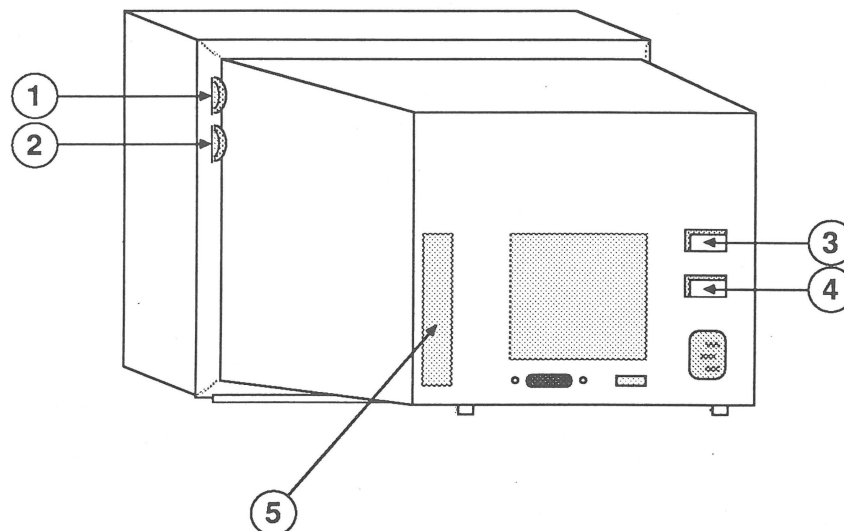


FIGURE 1

The brightness control (Figure 1, #1) and contrast control (Figure 1, #2) for the AppleColor High-Res RGB Monitor are on the case side (at the right as you face the screen). The power switch (Figure 1, #3) and the degauss switch (Figure 1, #4) are located at the back.

Less frequently used controls are at the back of the monitor, under a snap-out door (Figure 1, #5). The user manual warns owners not to touch certain of these controls, but it is possible that well-meaning users will sometimes misalign them.

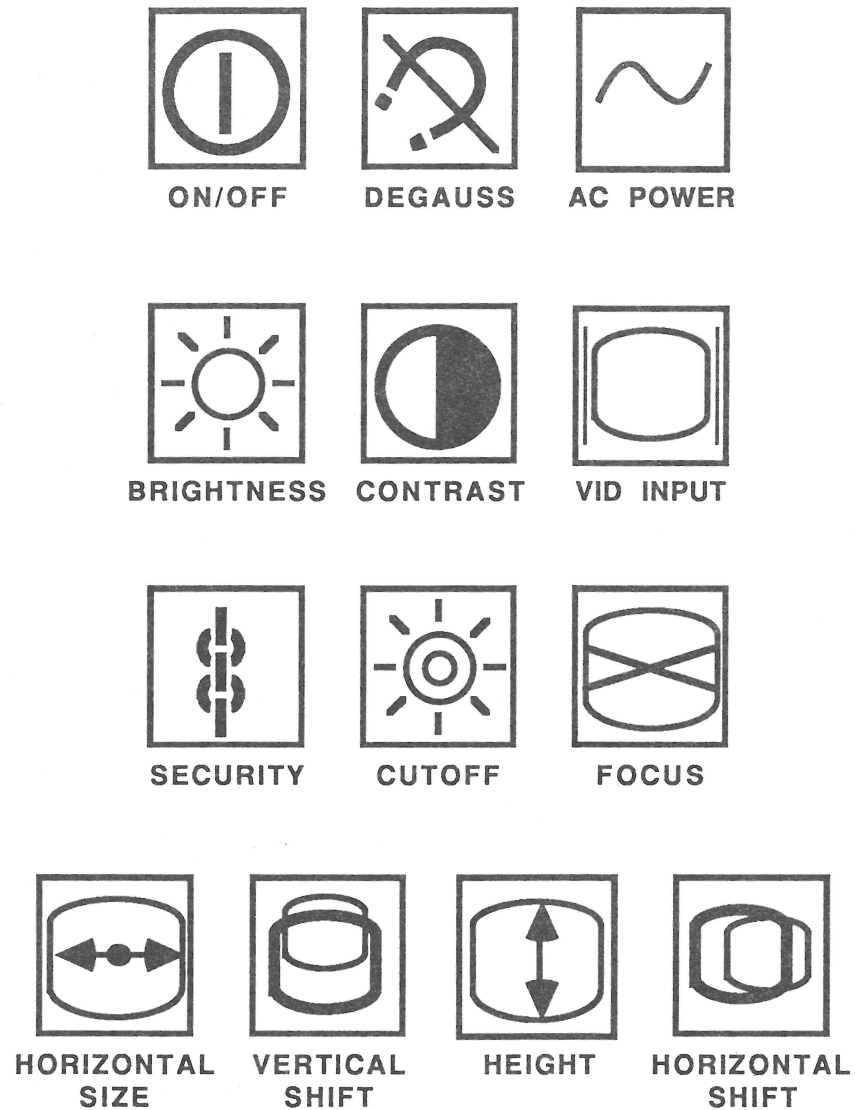


FIGURE 2

Internationally recognized symbols, shown in Figure 2, are used to identify the external controls.

Note: On newer units, the cutoff adjustment is not accessible externally.

The monitor is designed for ease of maintenance and servicing, with board screening and color-coding throughout.

□ CARE AND HANDLING

The AppleColor High-Res RGB Monitor is a complex precision instrument that must be handled with great care to ensure perfect operation. A drop of even one inch can cause the CRT to be permanently out of alignment.

Keep service modules and finished goods monitors in the Apple packaging until use, and return modules to Apple for repair packed in approved module packaging.

The AppleColor High-Res RGB Monitor contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

AppleColor High-Res RGB Monitor

Section 2 – Take-Apart

❑ CONTENTS

2.2	Cover
2.4	Electromagnetic Interference (EMI) Shield
2.5	Discharging the Cathode-Ray Tube (CRT)
2.5	Discharge Procedure
2.7	Anode Cap
2.8	Video Board "C"
2.11	Video Color Board Assembly
2.15	Main Logic Board "D"
2.21	Power supply
2.23	Fuses
2.26	On/Off Switch
2.28	Degauss Switch
2.30	Contrast Control Board "J"
2.32	High-Voltage Capacitor
2.38	Chassis Frame
2.42	Cathode-Ray Tube (CRT)
2.43	LED

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

□ COVER

WARNING: The AppleColor Ri-Res RGB Monitor contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the cover. **Failure to follow the safety rules could result in serious injury.**

Materials Required

Medium Phillips screwdriver

Remove

1. Power off the monitor and disconnect the AC power cord and video cable.
2. Gently place the monitor face down on a soft, protective surface.

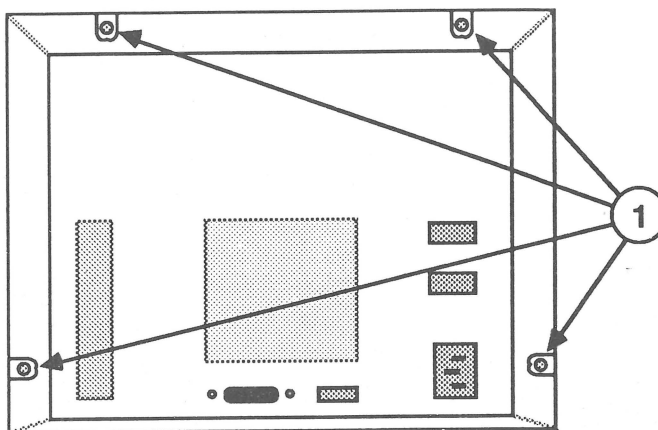


FIGURE 1

3. Remove the four case screws (Figure 1, #1).
4. Slide the cover off the monitor chassis and set it aside.
5. Carefully set the monitor upright.

Replace

1. Carefully set the monitor face down on a soft, protective surface.

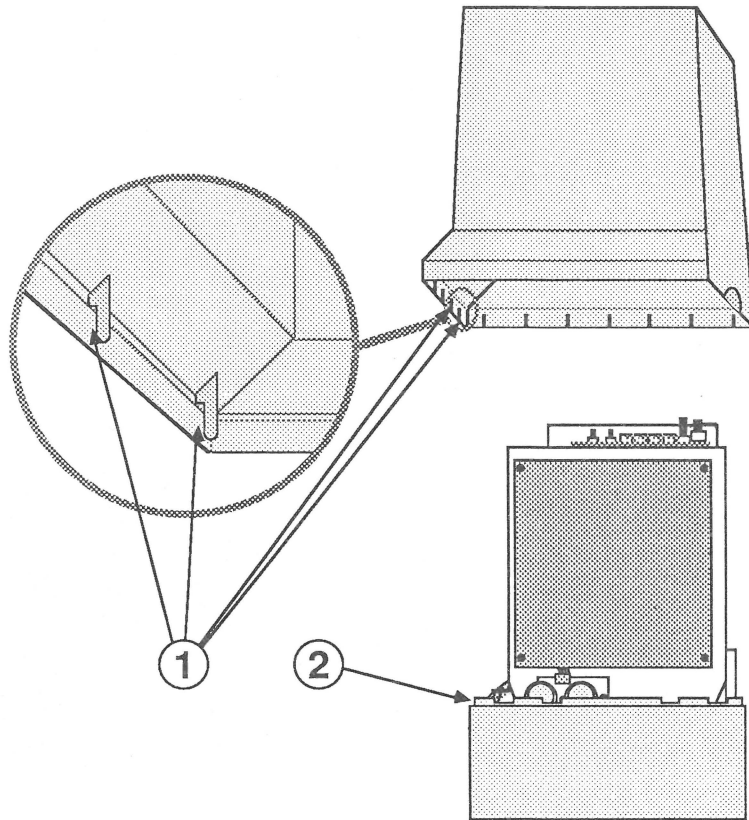


FIGURE 2

2. Slide the cover over the monitor chassis. Fit the "teeth" on the cover (Figure 2, #1) over the edges of the front bezel (Figure 2, #2).
3. Replace the four case screws (Figure 1, #1).
4. Carefully set the monitor upright.

□ ELECTROMAGNETIC INTERFERENCE (EMI) SHIELD

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.

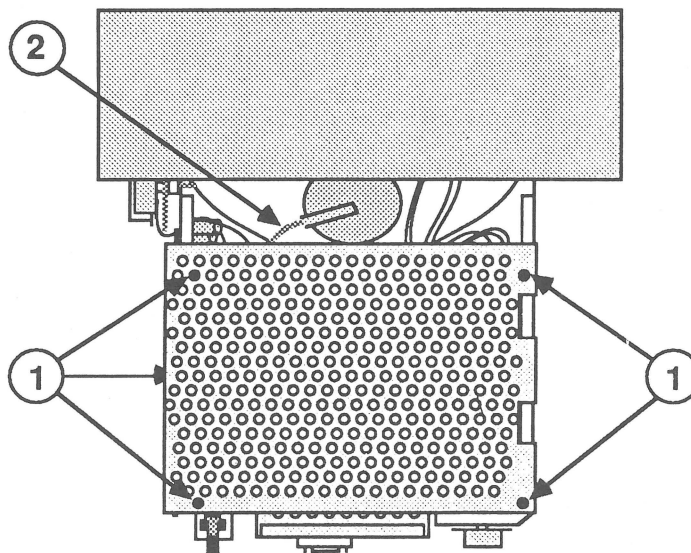


FIGURE 3

2. Remove the five screws (Figure 3, #1) that hold the shield in place.
3. Lift the shield off the chassis; then gently pull and twist the shield to release the anode wire (Figure 3, #2) from the cable clamp. Make sure you do not touch the anode wire.

Replace

1. Fit the EMI shield over the monitor chassis, matching up screw holes on top and side.
2. Replace the five Phillips screws (Figure 3, #1).
3. Replace the anode wire (Figure 3, #2) in the cable clamp on the shield.
4. Replace the cover.

□ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The AppleColor High-Res RGB Monitor contains a bleeder resistor that automatically drains the charge from the CRT when power is off. **Follow the discharge procedure below to ensure your safety in the event that the resistor failed and the anode is still charged.**

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, *CRT Safety, under the You Oughta Know tab*. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are also given in that section.

Discharge Procedure

1. Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!

WARNING: To prevent serious injury, do not touch the yoke wires (Figure 4, #1), the anode wire (Figure 4, #2), the anode connector (Figure 4, #3), or the flyback transformer (Figure 4, #4).

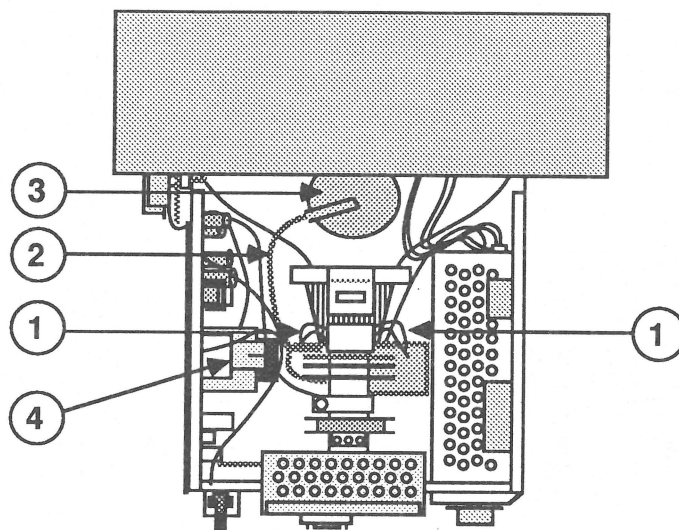


FIGURE 4

2. Remove the cover and EMI shield.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

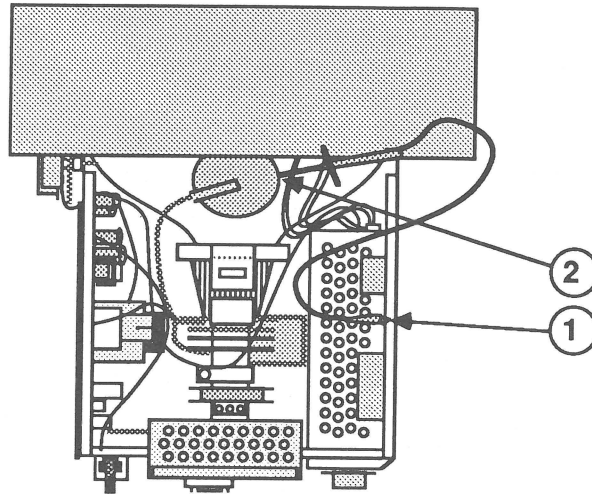


FIGURE 5

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 5, #1).
5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 5, #2) until the probe touches the anode ring.
7. Remove the probe of the CRT discharge tool from under the anode cap and detach the alligator clip from the metal chassis.

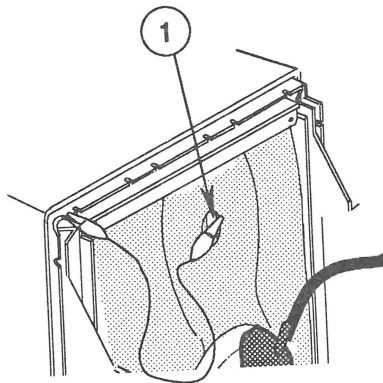


FIGURE 6

Note: If the bleeder resistor fails, a secondary charge could build up over a period of time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode aperture (Figure 6, #1).

Anode Cap

For some procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode ring (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, then press down around the edges of the rubber anode cap to ensure a firm seal.

□ VIDEO BOARD "C"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
4. Remove the EMI shield.

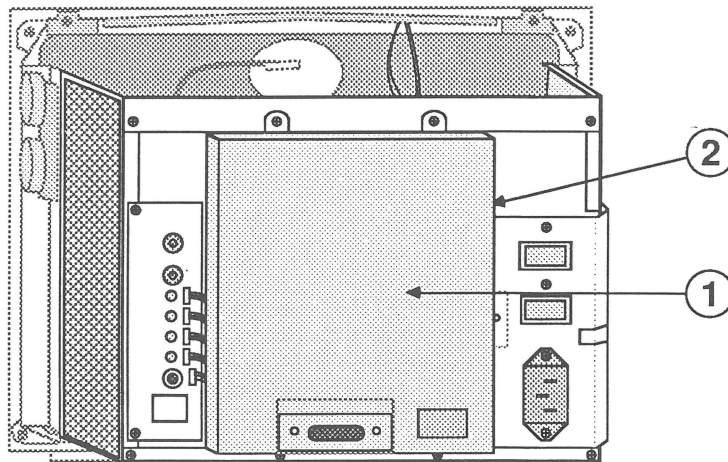


FIGURE 7

5. Turn the monitor so that the back is facing you and pull off the metal video board shield (Figure 7, #1).
6. Remove the screw that secures the black ground wires to the right side of the video color board assembly frame. (The screw is located under the shield in the area noted by Figure 7, #2.)
7. Pull video board "C" (Figure 8, #1) off the neck of the CRT (Figure 8, #2) and turn it out slightly.
8. The wires of video board "C" connect to color video board "B." Detach from board "B" the connectors listed in Table 1 and shown in Figure 8.

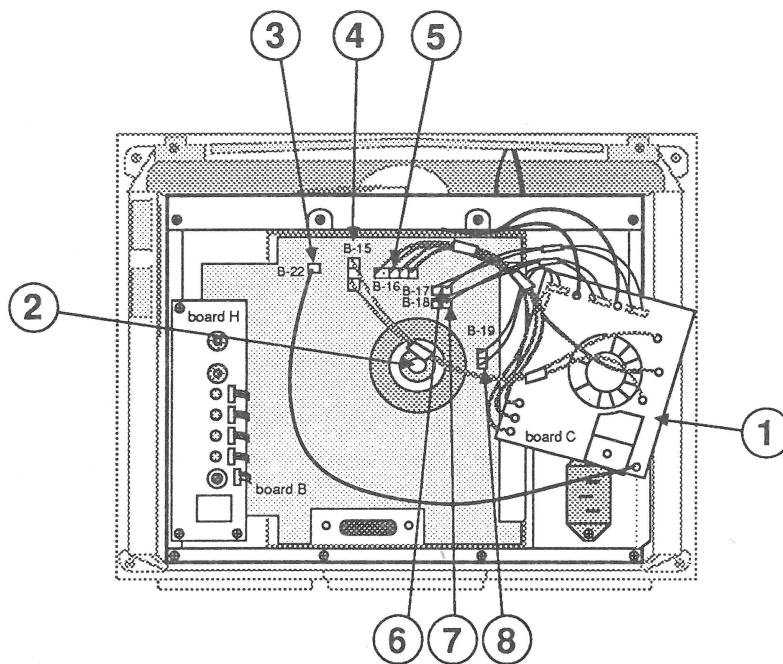


FIGURE 8

CAUTION: Excessive force may pull the connectors off the board. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

Number	Location	No. wires	Conn. color
B-22	Figure 8, #3	1	gray
B-15	Figure 8, #4	2	white (lg)
B-16	Figure 8, #5	4	white (lg)
B-17	Figure 8, #6	2	black
B-18	Figure 8, #7	2	yellow
B-19	Figure 8, #8	2	red

TABLE 1

Replace

1. Reconnect to video color board "B" all connectors from video board "C" that are listed in Table 1.
2. Replace video board "C" (Figure 8, #1) on the neck of the CRT (Figure 8, #2). It fits only one way.

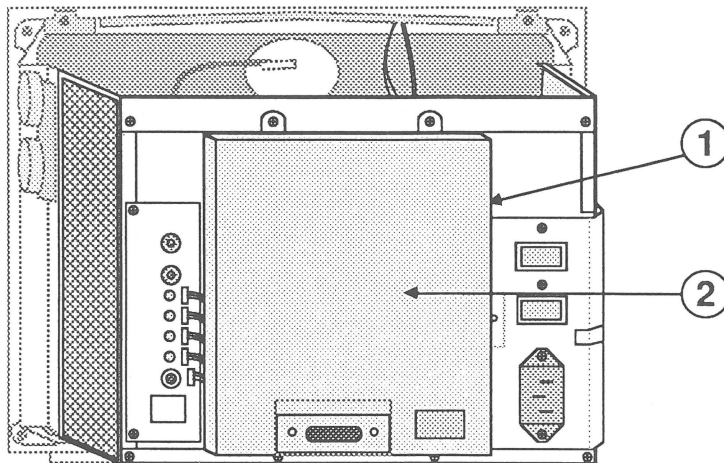


FIGURE 9

3. Replace the screw that secures the black ground wires to the right side of the video color board assembly frame. (The screw is located under the shield in the area noted by Figure 9, #2.)
4. Replace the metal video board shield (Figure 9, #1). It simply slides on and snaps into place.
5. Replace the EMI shield.
6. Replace the cover.
7. Make sure the monitor is adjusted correctly. Perform the monitor inspection described in Section 4, Troubleshooting.

□ VIDEO COLOR BOARD ASSEMBLY

The video color board assembly is composed of three boards (labeled "H," "B," and "Q"), the metal frame that supports them, and the exterior I/O connector and its frame.

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
4. Remove video board "C."

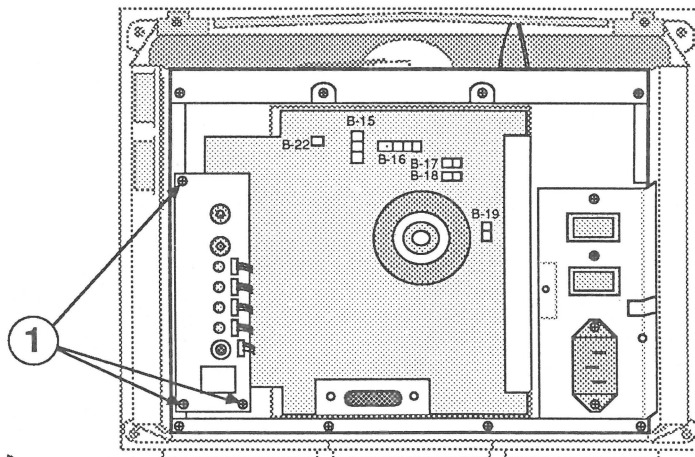


FIGURE 10

5. Remove the three screws (Figure 10, #1) that secure board "H" to the metal chassis frame, and pull the board out a little.

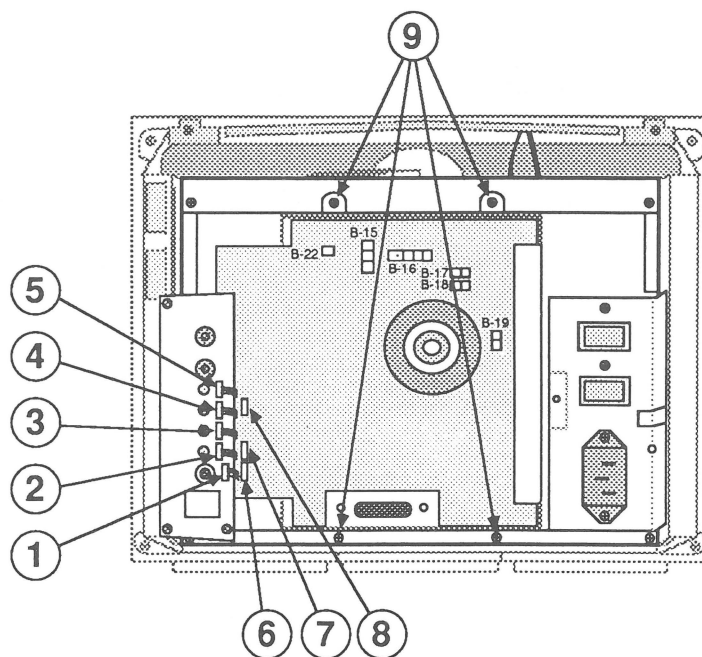


FIGURE 11

6. The wires of boards "B" and "H" connect to main logic board "D." Detach from boards "B" and "H" the connectors listed in Table 2 and shown in Figure 11. **Leave the wires connected to main logic board "D."**

CAUTION: Excessive force may pull the connectors off the board. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

Number	Location	No. wires	Conn. color
H-10	Figure 11, #1	3	yellow
H-14	Figure 11, #2	3	white
H-13	Figure 11, #3	3	black
H-12	Figure 11, #4	3	red
H-11	Figure 11, #5	3	white
B-2	Figure 11, #6	3	white
B-21	Figure 11, #7	4	yellow
B-1	Figure 11, #8	4	black

TABLE 2

7. Detach from main logic board "D" the two connectors listed in Table 3 and shown in Figure 12.

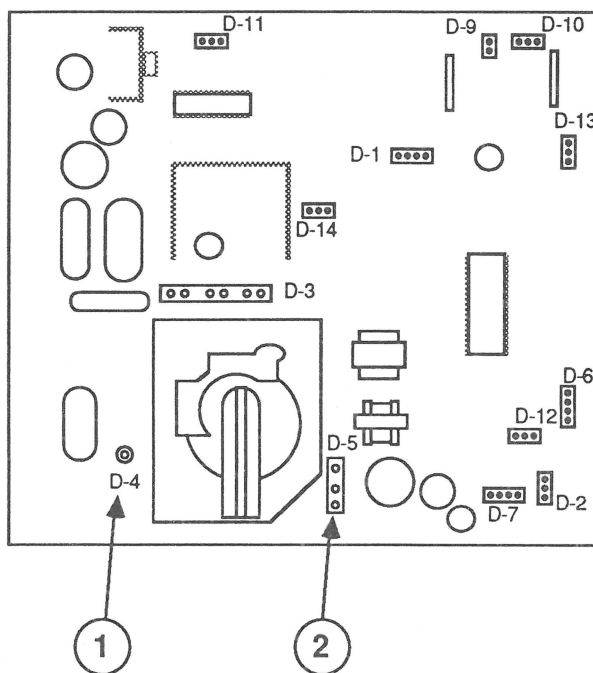


FIGURE 12

Number	Location	No. wires	Conn. color
D-4	Figure 12, #1	1	gray
D-5	Figure 12, #2	2	white (lg)

TABLE 3

8. Remove the four screws (Figure 11, #9) that secure the frame of the video color board assembly to the chassis frame. Remove the video color board assembly.

Replace

1. Set the video color board assembly in the chassis frame and replace the four screws (Figure 11, #9).
2. Reconnect to main logic board "D" the two wires listed in Table 3 and shown in Figure 12.
3. Locate the wires from main logic board "D" that are listed in Table 2. Route the wires between board "B" and board "H" and reconnect them to their connectors on boards "B" and "H" (Figure 11).

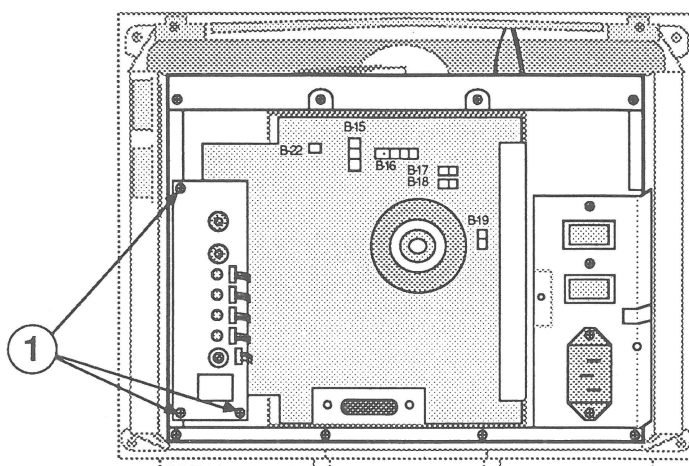


FIGURE 13

4. Replace the three screws (Figure 13, #1) that secure board "H" to the chassis frame.
5. Replace video board "C." (Be sure to replace the video board shield.)
6. Replace the cover.
7. Set the monitor cutoff (see Section 3, Adjustments), and inspect monitor adjustments (see Section 4, Troubleshooting).

□ MAIN LOGIC BOARD "D"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)

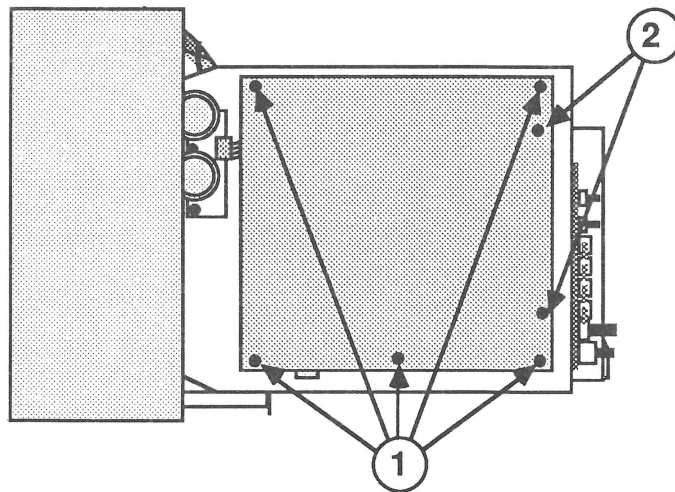


FIGURE 14

5. Remove the five screws (Figure 14, #1) that secure main logic board "D" to the metal chassis frame.
6. Using needlenose pliers, compress the sides of the plastic clamps (Figure 14, #2) one at a time and pull the board off the clamps. (In some monitors, there is only one clamp.)

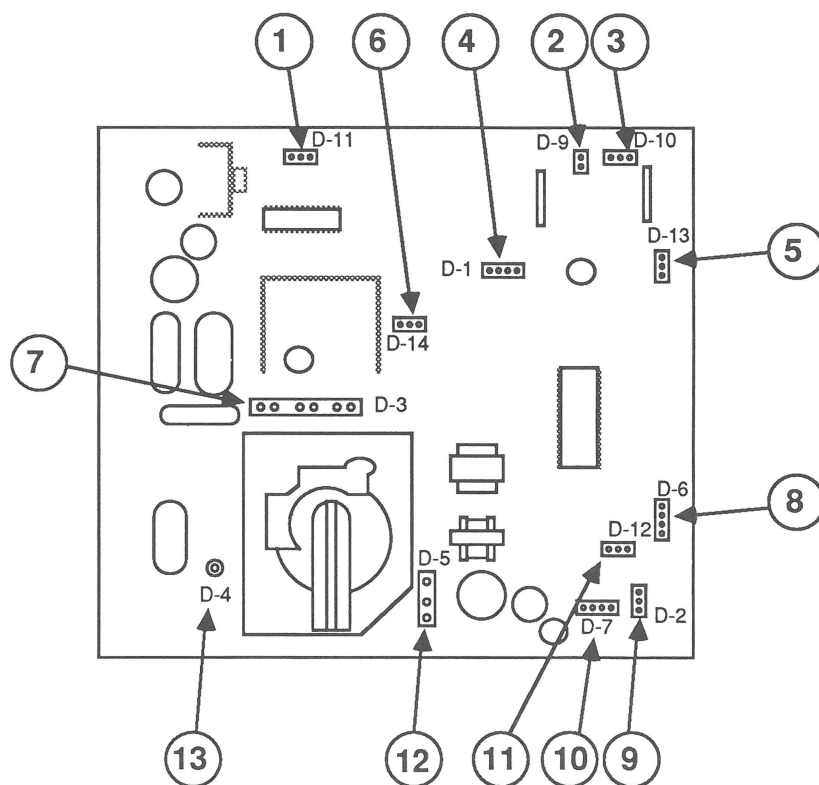


FIGURE 15

7. Pull main logic board "D" slightly out from the metal frame. Disconnect from board "D" the connectors listed in Table 4 and shown in Figure 15. **Leave the wires connected to the video color board assembly.**

CAUTION: Excessive force may pull the connectors off the board. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

Number	Location on "D"	No. wires	Conn. color	To or From
D-11	Figure 15, #1	3	white	"H"
D-9	Figure 15, #2	2	white	CRT neck
D-10	Figure 15, #3	3	yellow	"H"
D-1	Figure 15, #4	4	black	"B"
D-13	Figure 15, #5	3	black	"H"
D-14	Figure 15, #6	3	white	"H"
D-3	Figure 15, #7	4	white (lg)	CRT yoke
D-6	Figure 15, #8	4	red	hi-volt. cap.
D-2	Figure 15, #9	3	white	"B"
D-7	Figure 15, #10	4	white	power supply
D-12	Figure 15, #11	3	red	"H"
D-5	Figure 15, #12	2	white (lg)	"B"
D-4	Figure 15, #13	1	gray	"H"

TABLE 4

...Continued on next page

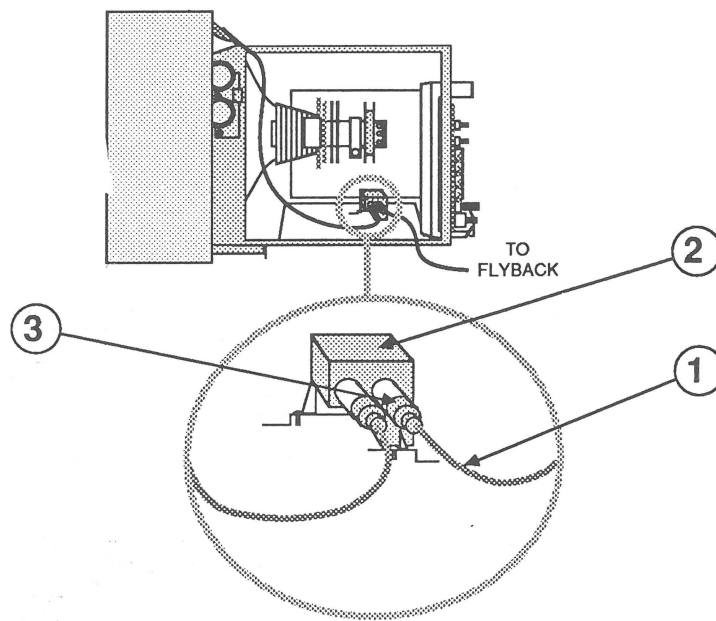


FIGURE 16

Note: For simplicity, Figure 16 shows the wire and high-voltage capacitor, but does not show the logic board and flyback.

8. Set the logic board down beside the chassis on the workbench surface. At this point, the logic board is free except for the rubberized wire (Figure 16, #1) that connects the flyback to the high-voltage capacitor (Figure 16, #2) on the floor of the monitor.

CAUTION: *The flyback wire connector can be easily bent or damaged. Be extra careful when removing the flyback wire from the capacitor; be sure to push in and rotate the wire one-quarter-turn counterclockwise before pulling it out.*

9. To release the flyback wire, first peel back the wire's rubber boot (Figure 16, #3) from the opening in the plastic capacitor housing. Then insert needlenose pliers into the opening in the plastic housing, and grasp the wire as close as possible to the capacitor. Push the wire in (toward the capacitor), rotate it one-quarter turn counterclockwise, and pull the wire out. The wire will come out easily once it has been rotated counterclockwise. (This procedure can be a little tricky—you may have to try it a couple of times.) Lift the logic board free.

Replace

1. Insert the flyback wire (Figure 16, #1) in the right-hand opening in the plastic capacitor housing. Push in firmly and turn the wire one-quarter turn clockwise. Tug on the wire to make sure it is firmly seated. Replace the wire's rubber boot (Figure 16, #3) around the opening of the plastic capacitor housing.
2. Reconnect to main logic board "D" the connectors listed in Table 5 and shown in Figure 17.

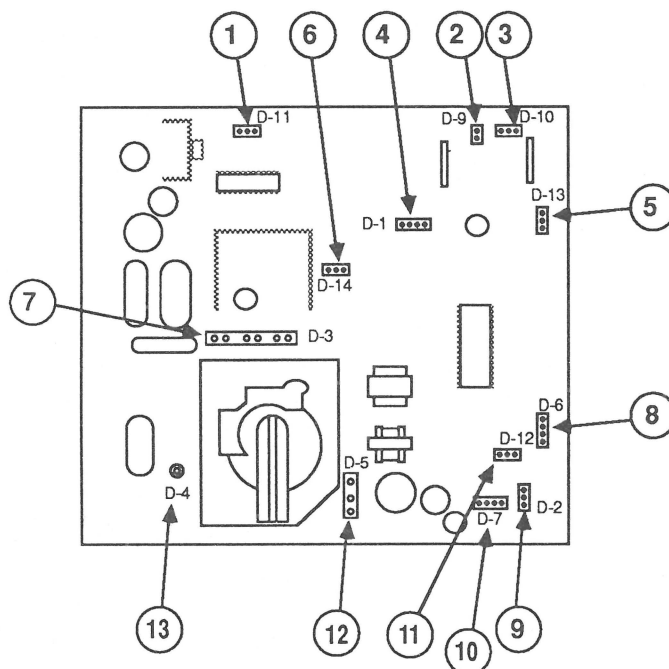


FIGURE 17

Number	Location on "D"	No. wires	Conn. color	To or From
D-11	Figure 17, #1	3	white	"H"
D-9	Figure 17, #2	2	white	CRT neck
D-10	Figure 17, #3	3	yellow	"H"
D-1	Figure 17, #4	4	black	"B"
D-13	Figure 17, #5	3	black	"H"
D-14	Figure 17, #6	3	white	"H"
D-3	Figure 17, #7	4	white (lg)	CRT yoke
D-6	Figure 17, #8	4	red	hi-volt. cap.
D-2	Figure 17, #9	3	white	"B"
D-7	Figure 17, #10	4	white	power supply
D-12	Figure 17, #11	3	red	"H"
D-5	Figure 17, #12	2	white (lg)	"B"
D-4	Figure 17, #13	1	gray	"H"

TABLE 5

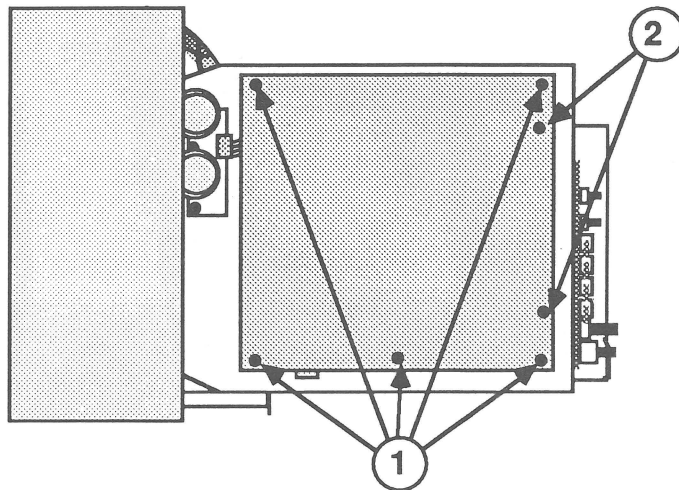


FIGURE 18

3. Using needlenose pliers, compress the plastic clamps one at a time to fit them into the corresponding holes on the board (Figure 18, #2). If there are two clamps on the chassis but only one hole on the board, remove the chassis clamp for which there is not a corresponding board hole.
4. Replace the five screws (Figure 18, #1) that secure main logic board "D" to the metal chassis frame.
5. Replace the EMI shield.
6. Replace the cover.
7. Set the monitor cutoff (see Section 3, Adjustments), and inspect monitor adjustments (see Section 4, Troubleshooting).

❑ POWER SUPPLY

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)

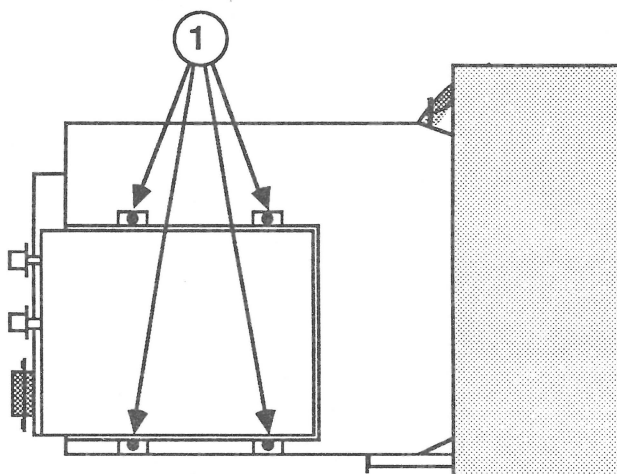


FIGURE 19

5. Remove the four screws that secure the power supply to the chassis frame (Figure 19, #1).
6. Slide the power supply back slightly.

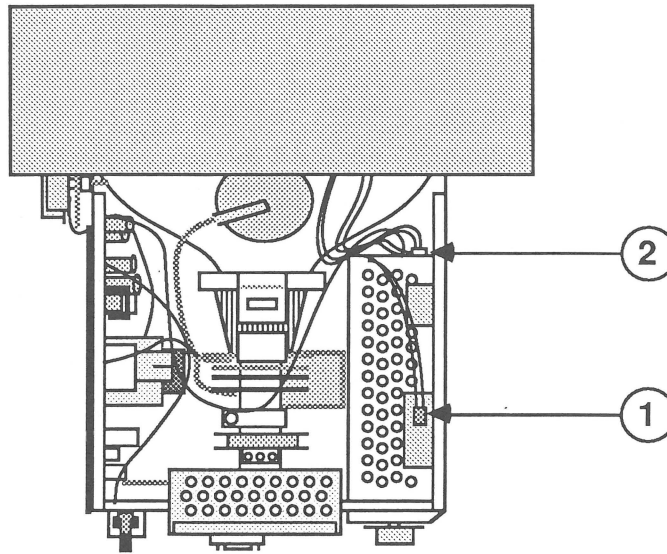


FIGURE 20

7. Disconnect the large two-wire connector from the top of the power supply (Figure 20, #1) and the small four-wire connector from the front side of the power supply (Figure 20, #2).
8. Slide the power supply back and out of the chassis.

Replace

1. Slide the power supply partly into the chassis frame, making sure the four tabs on the power supply are **outside** the chassis frame.
2. Reconnect the small four-wire connector to the front side of the power supply (Figure 20, #2).
3. Reconnect the large two-wire connector to the top of the power supply (Figure 20, #1). Be sure the white wire is toward the **rear** of the monitor.
4. Match up the screw holes on the chassis frame with those on the power supply tabs, and replace the four screws (see Figure 19, #1, on the previous page).
5. Replace the EMI shield.
6. Replace the cover.

□ FUSES

Materials Required

Medium Phillips screwdriver
Small flatblade screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
5. Remove the power supply.

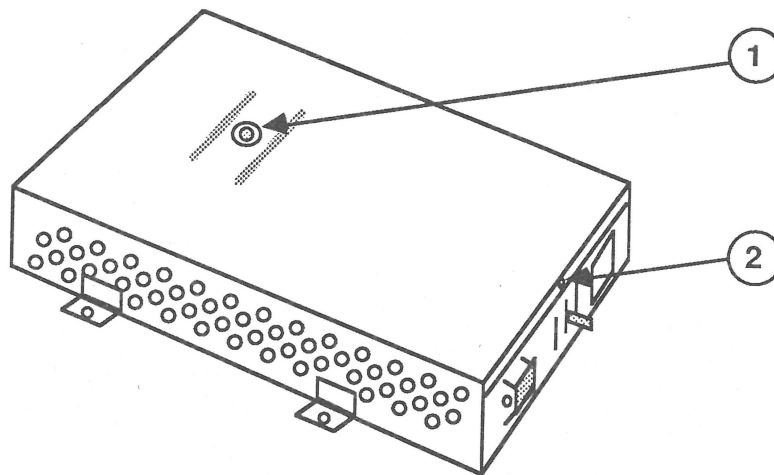


FIGURE 21

6. Remove the top screw and washer (Figure 21, #1) and the end screw (Figure 21, #2) from the power supply cover. Lift the cover free.

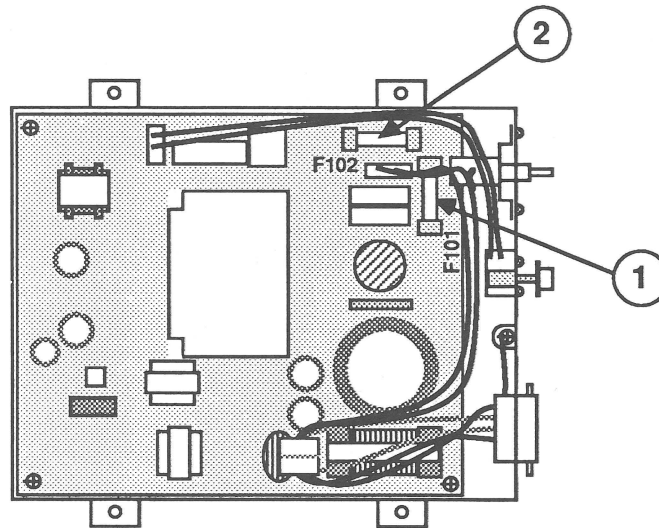


FIGURE 22

7. There are two fuses in the power supply:

- 6.3A 250V fuse at position F101 (Figure 22, #1)
- 3.15A 250V fuse at position F102 (Figure 22, #2)

Remove a blown fuse by gently prying up one end of the fuse with your fingers or a flatblade screwdriver and lifting it out.

Replace

1. Carefully snap the new fuse into the appropriate fuse holder. A 6.3A 250V fuse must be used at position F101 (Figure 22, #1), and a 3.15A 250V fuse must be used at position F102 (Figure 22, #2).
2. Insert the end tabs (Figure 23, #1) on the power supply cover in the slots (Figure 23, #2) on the power supply housing. Snap the cover down.

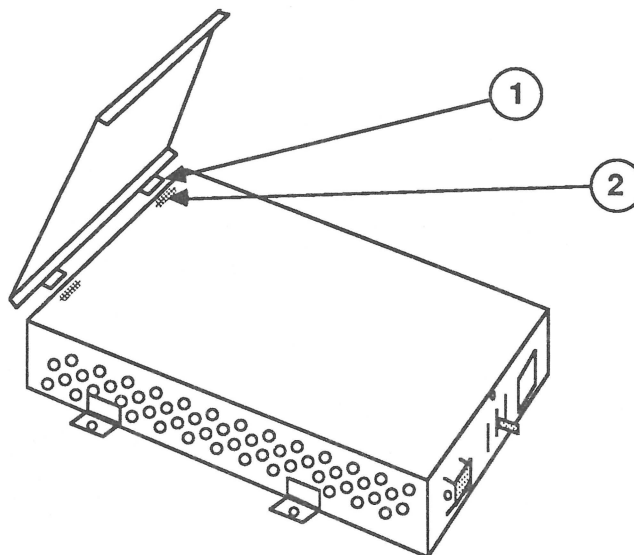


FIGURE 23

3. Replace the top screw and washer (Figure 24, #1) and the end screw (Figure 24, #2) that secure the metal cover to the power supply.

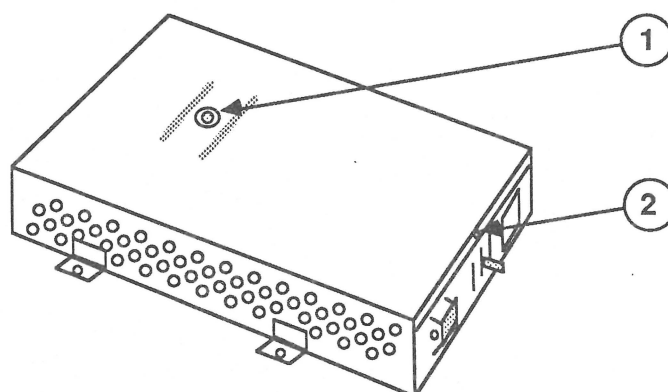


FIGURE 24

4. Replace the power supply.
5. Replace the EMI shield.
6. Replace the cover.

□ ON/OFF SWITCH

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap.
4. Remove the power supply.

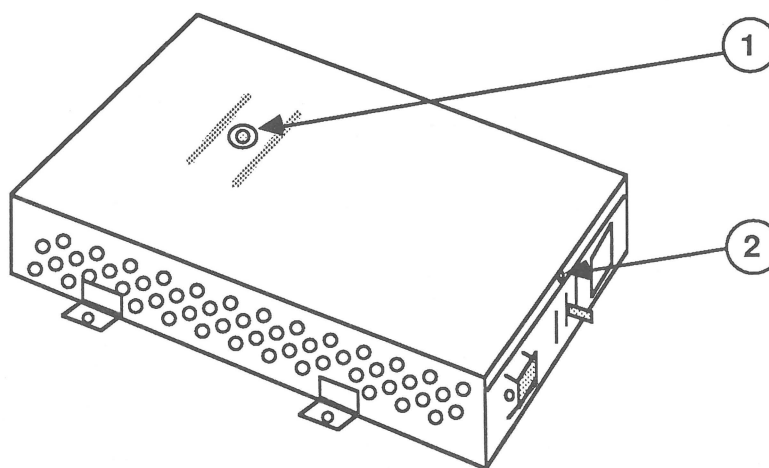


FIGURE 25

5. Remove the screw and washer (Figure 25, #1) and the screw (Figure 25, #2) that secure the metal cover to the power supply.
6. Pull the plastic knob off the power switch stem (Figure 26, #1).
7. Desolder the two power switch wires (Figure 26, #2) from the switch.
8. Remove the two outside screws (Figure 26, #3) that secure the power switch bracket to the power supply housing and lift out the switch assembly.

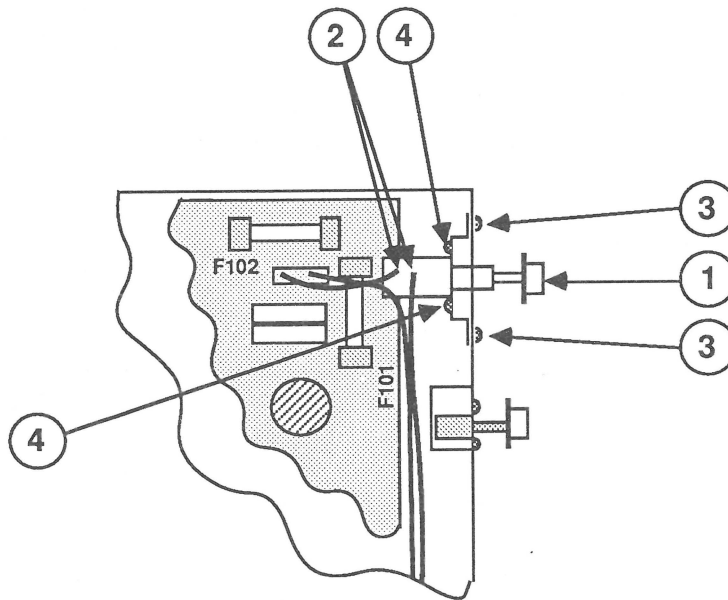


FIGURE 26

9. Remove the two tiny screws (Figure 26, #4) that secure the power switch to its bracket. **Keep the bracket to install on the replacement switch.**

Replace

1. Install the switch on its metal bracket and replace the two tiny screws (Figure 26, #4).
2. Install the switch assembly inside the power supply housing and replace the two screws (Figure 26, #3).
3. Solder the two power switch wires (Figure 26, #2) to the switch. (Wire positions are interchangeable.)
4. Install the power supply knob on the switch stem (Figure 26, #1).
5. Insert the end tabs of the power supply cover into the slots on the power supply housing. Snap down the cover.
6. Replace the top screw and washer (Figure 25, #1) and the end screw (Figure 25, #2) that secure the metal cover to the power supply.
7. Replace the power supply.
8. Replace the EMI shield.
9. Replace the cover.

□ DEGAUSS SWITCH

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
5. Remove the power supply.

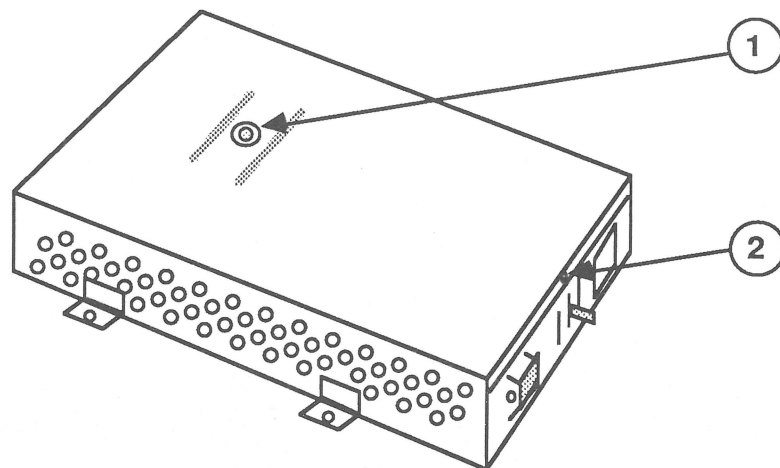


FIGURE 27

6. Remove the top screw and washer (Figure 27, #1) and the end screw (Figure 27, #2) from the power supply cover. Lift the cover free.
7. Pull the plastic knob off the degauss switch stem (Figure 28, #1).
8. Remove the two screws (Figure 28, #2) that secure the degauss switch to the power supply housing.

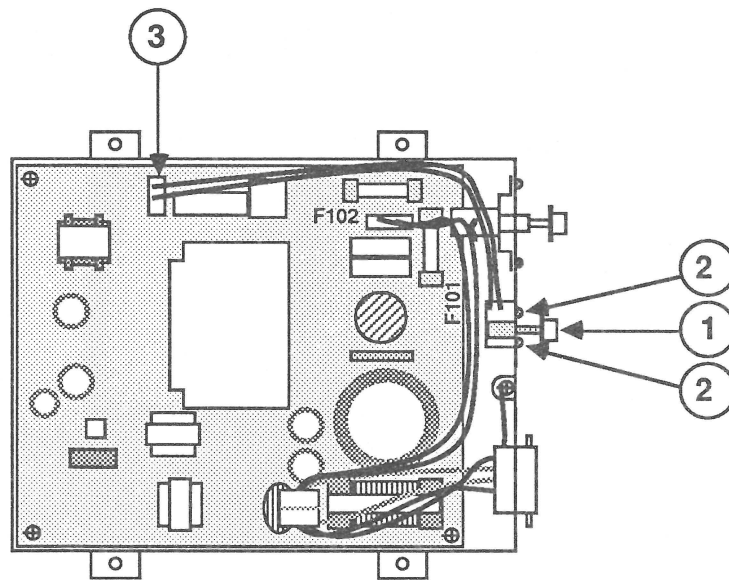


FIGURE 28

9. Disconnect the degauss connector from CN202 on the power supply board (Figure 28, #3).

Replace

1. Reconnect the degauss connector to CN202 on the power supply board (Figure 28, #3).
2. Install the degauss switch in its place inside the power supply housing and replace the two screws (Figure 28, #2).
3. Replace the degauss knob on the switch stem (Figure 28, #1).
4. Insert the end tabs on the power supply cover in the slots on the power supply housing. Snap down the cover.
5. Replace the top screw and washer (Figure 27, #1) and the end screw (Figure 27, #2) that secure the metal cover to the power supply.
6. Replace the power supply.
7. Replace the EMI shield.
8. Replace the cover.

□ CONTRAST CONTROL BOARD "J"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)

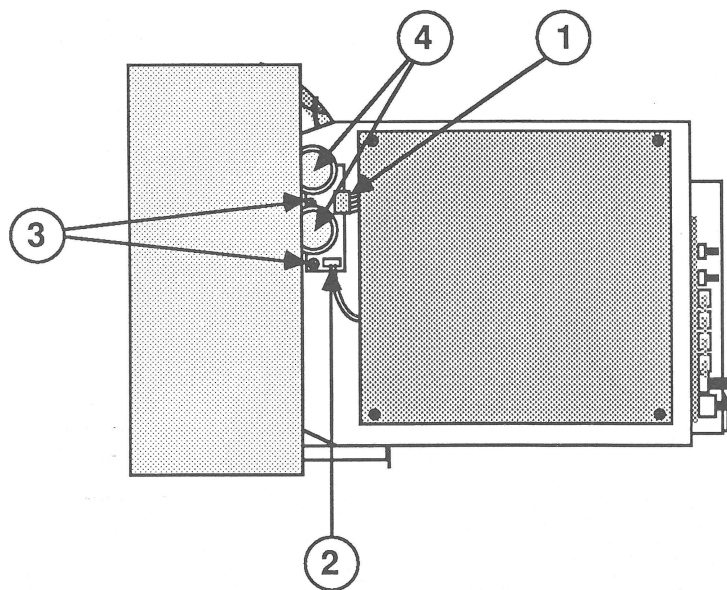


FIGURE 29

4. Disconnect the yellow four-wire connector J-21 (Figure 29, #1) and the white two-wire connector J-8 (Figure 29, #2) from the contrast control board.
5. Remove the two screws (Figure 29, #3) that secure the contrast control board to the chassis frame.
6. Pull the knobs (Figure 29, #4) off the contrast control board, and save them to put on the replacement board.

Replace

1. Install the customer's knobs (Figure 29, #4) on the replacement contrast control board.
2. Place the contrast control board on the chassis frame and replace the two screws (Figure 29, #3).
3. Reconnect the yellow four-wire connector J-21 (Figure 29, #1) and the white two-wire connector J-8 (Figure 29, #2) to the contrast control board.
4. Replace the cover.
5. Make sure the monitor is adjusted correctly. Perform the monitor inspection described in Section 4, Troubleshooting.

□ HIGH-VOLTAGE CAPACITOR

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Discharge the CRT.
3. Remove the anode cap.
4. Place the monitor **face down** on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)

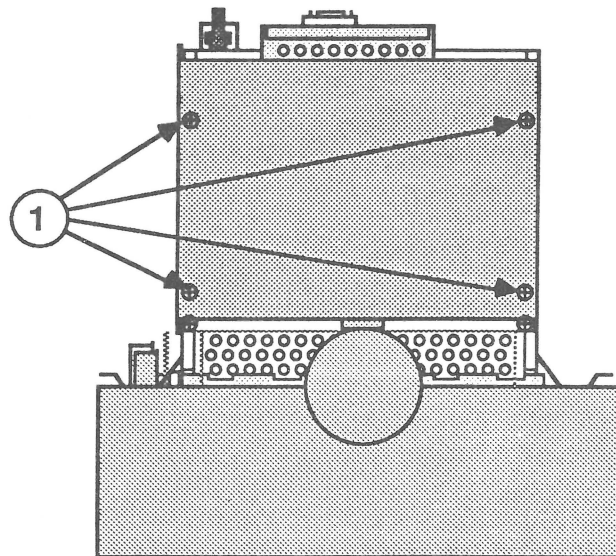


FIGURE 30

5. From the bottom of the chassis, remove the four screws (Figure 30, #1) that secure the metal screen to the chassis frame.
6. Tip the metal screen toward you until you can see the high-voltage capacitor (Figure 31, #1) that is attached to the upper surface of the screen.

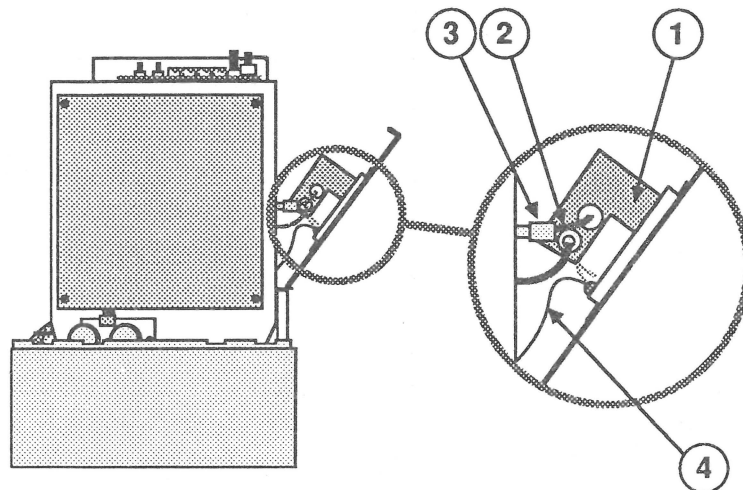


FIGURE 31

CAUTION: *The flyback wire connector can be easily bent or damaged. Be extra careful when removing the flyback wire from the capacitor; be sure to push in and rotate the wire one-quarter turn counterclockwise before pulling the wire out.*

7. Locate the rubberized wire (Figure 31, #2) that connects the flyback to the high-voltage capacitor. To release this wire, first peel back the wire's rubber boot (Figure 31, #3) from the opening in the plastic capacitor housing. Then insert needlenose pliers into the opening in the plastic housing, and grasp the wire as close as possible to the capacitor. Push the wire in (toward the capacitor), rotate it one-quarter turn counterclockwise, and pull the wire out. The wire will come out easily once it has been rotated counterclockwise. (This procedure can be a little tricky—you may have to try it a couple of times.)
8. Disconnect the gray wire (Figure 31, #4) from its red, four-wire connector at D-6 on main logic board "D."

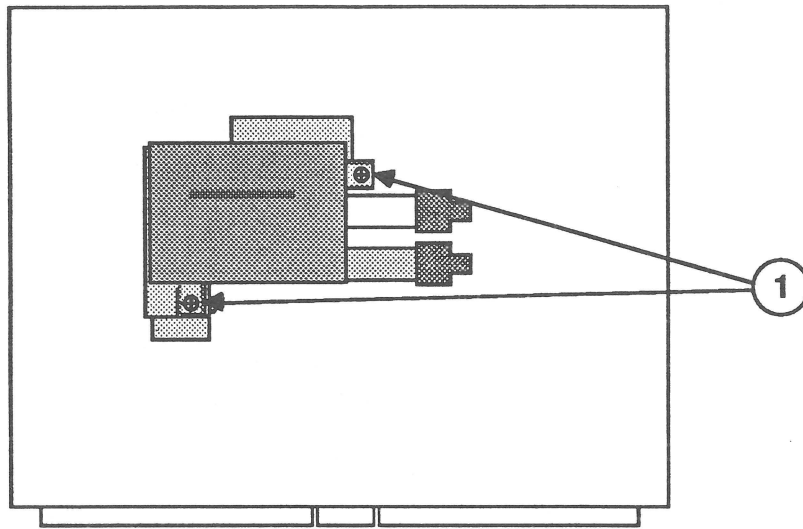


FIGURE 32

9. Lift off the metal screen (with the high-voltage capacitor attached).
10. Remove the two screws (Figure 32, #1) that secure the high-voltage capacitor to its bracket on the screen. Lift off the high-voltage capacitor.

Replace

1. Place the high-voltage capacitor over its bracket on the bottom screen and replace the two screws (Figure 32, #1).
2. Prop up the bottom metal screen against the bottom of the metal chassis frame, as shown in Figure 33.

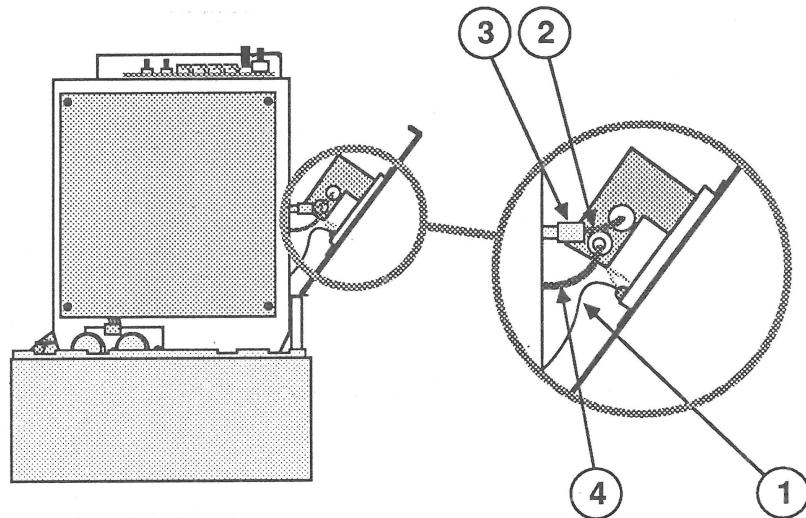


FIGURE 33

3. Reconnect the gray wire (Figure 33, #1) to its red, four-wire connector at D-6 on main logic board "D." (The connector is located on the lower front edge of the logic board near the CRT. If you need help locating it, refer to the main logic board "D" layout in Figure 15.)
4. Insert the rubberized wire from the flyback (Figure 33, #2) in the right-hand opening in the plastic housing of the high-voltage capacitor. Push it in firmly and turn it one-quarter turn clockwise. Tug on the wire to make sure it is firmly seated. Replace the wire's rubber boot (Figure 33, #3) around the opening of the plastic capacitor housing.
5. Replace all wires in their plastic cable clamps.
6. Route the anode wire (Figure 33, #4) up to the top of the CRT, fitting it through the space between the EMI shield and the CRT.

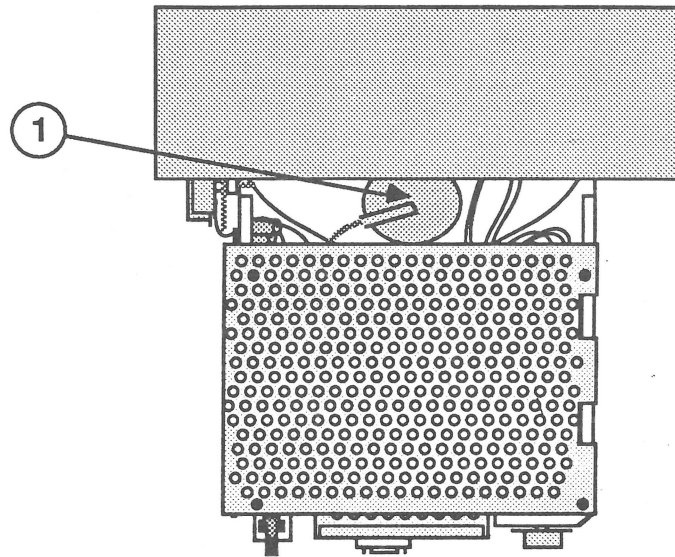


FIGURE 34

7. Turn the monitor so that you can see the anode aperture at the top of the CRT.
8. Replace the anode cap (Figure 34, #1).

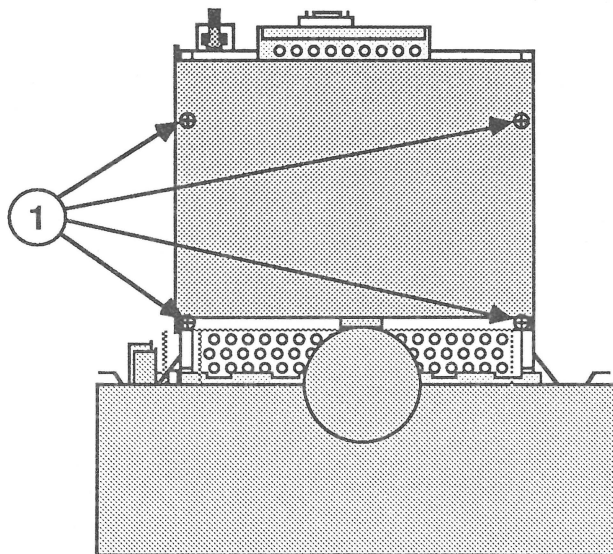


FIGURE 35

9. Turn the monitor so that the bottom is facing you. Position the bottom metal screen up against the chassis frame and replace the four screws (Figure 35, #1).
10. Replace the cover.

□ CHASSIS FRAME

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Remove the anode cap.
5. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)

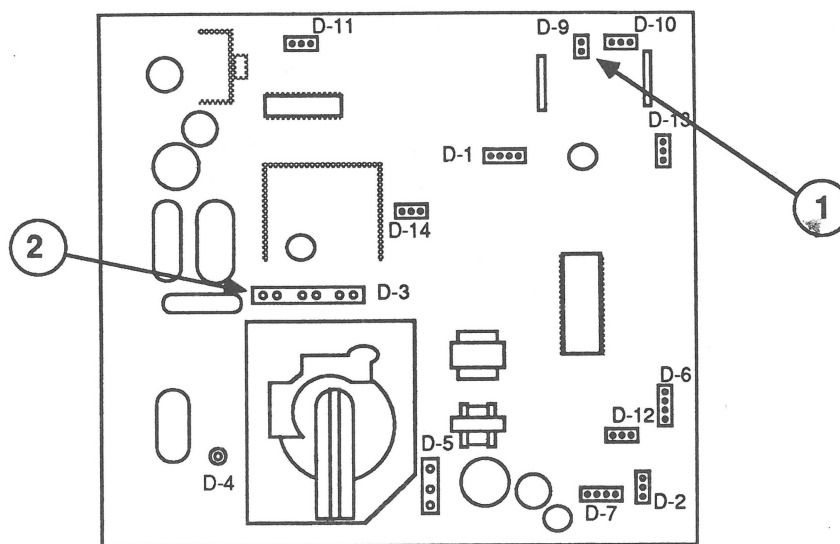


FIGURE 36

6. Disconnect from main logic board "D" the connectors that are listed in Table 6 and shown in Figure 36.

CAUTION: Excessive force may pull the connectors off the board. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

Number	Location on "D"	No. wires	Conn. color	To or From
D-9	Figure 36, #1	2	white	CRT neck
D-3	Figure 36, #2	4	white (lg)	CRT yoke

TABLE 6

7. Pull off the metal video board shield (Figure 37, #1).

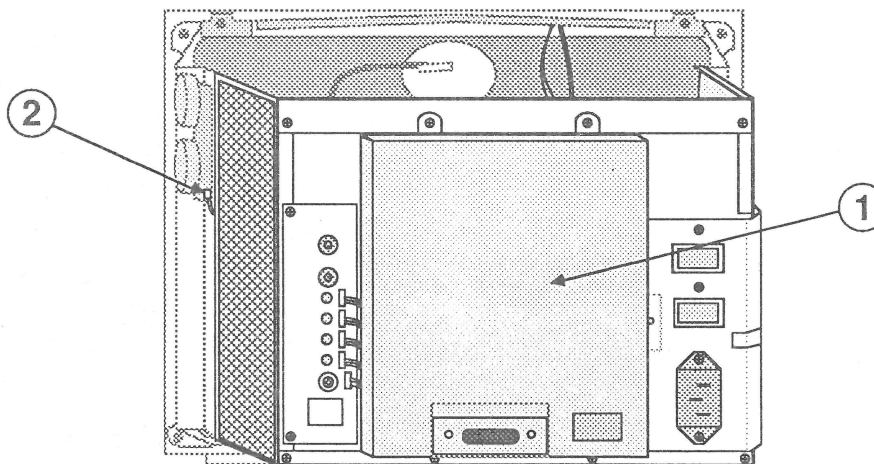


FIGURE 37

8. Disconnect J-8 (Figure 37, #2) from contrast control board "J."
9. Remove wires from plastic cable clamps.

...Continued on next page

10. Carefully pull video board "C" (Figure 38, #1) off the neck of the CRT (Figure 38, #2).

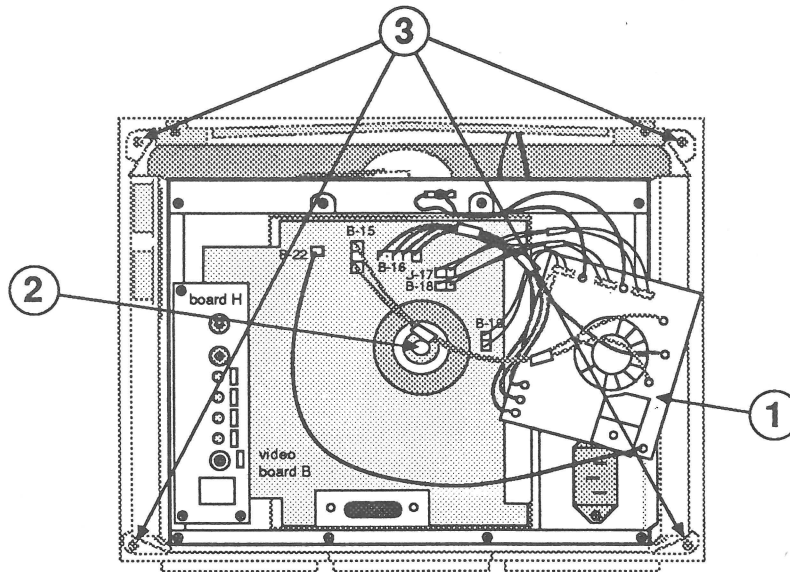


FIGURE 38

11. Place the monitor face down on the workbench pad.
12. Remove the four corner screws (Figure 38, #3) that secure the metal chassis frame to the front bezel. Lift off the frame (with attached modules).

Replace

1. Place the monitor face down on the workbench pad.
2. Fit the metal chassis frame (with attached modules) into the front bezel as shown in Figure 38.
3. Replace the four corner screws (Figure 38, #3) that secure both the metal chassis frame and the CRT to the front bezel.
4. Carefully replace video board "C" (Figure 38, #1) on the neck of the CRT (Figure 38, #2). It fits only one way.
5. Replace the metal video board shield (Figure 39, #1). It simply slides on and snaps into place.
6. Reconnect J-8 (Figure 39, #2) to contrast control board "J."

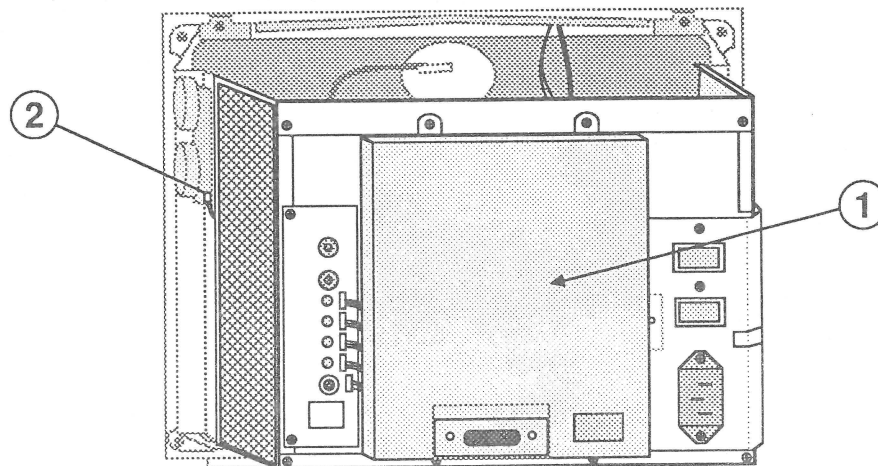


FIGURE 39

7. Reconnect to main logic board "D" the connectors listed in Table 7 and shown in Figure 40.

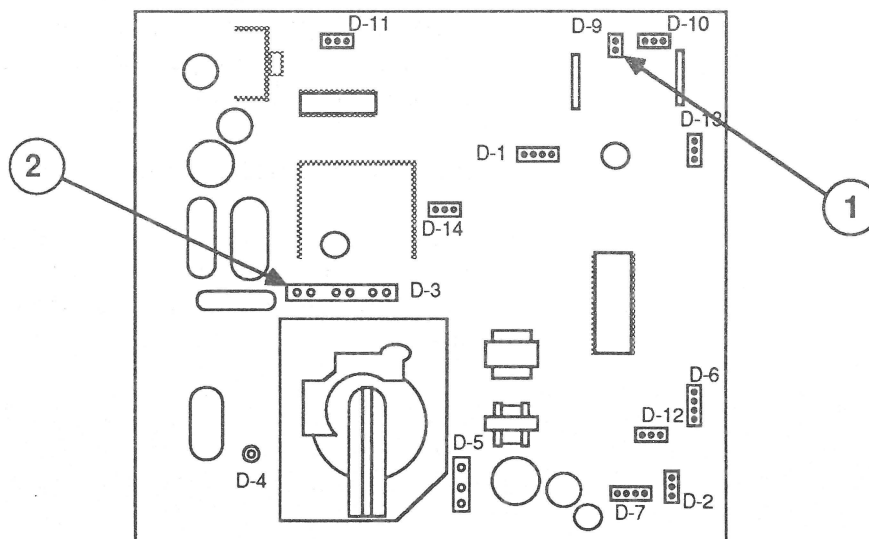


FIGURE 40

Number	Location on "D"	No. wires	Conn. color	To or From
D-9	Figure 40, #1	2	white	CRT neck
D-3	Figure 40, #2	4	white (lg)	CRT yoke

TABLE 7

8. Replace the anode cap, EMI shield, and cover.

□ CATHODE-RAY TUBE (CRT)

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Remove the anode cap.
5. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the wriststrap until after the CRT has been discharged.)
6. Remove the chassis frame.
7. Support the side of the CRT with one hand, tip the bezel to one side, and very carefully ease the CRT out of the bezel. **Do not handle the CRT by the neck!**

WARNING: *If you need to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the You Oughta Know tab.*

Replace

1. Place the CRT in the bezel with the anode aperture oriented toward the top of the bezel.
2. Replace the chassis frame and the anode cap.
3. Replace the EMI shield.
4. Replace the cover.
5. Set the monitor cutoff (see Section 3, Adjustments), and inspect monitor adjustments (see Section 4, Troubleshooting).

□ LED

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Remove the anode cap.
5. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
6. Remove the chassis frame.

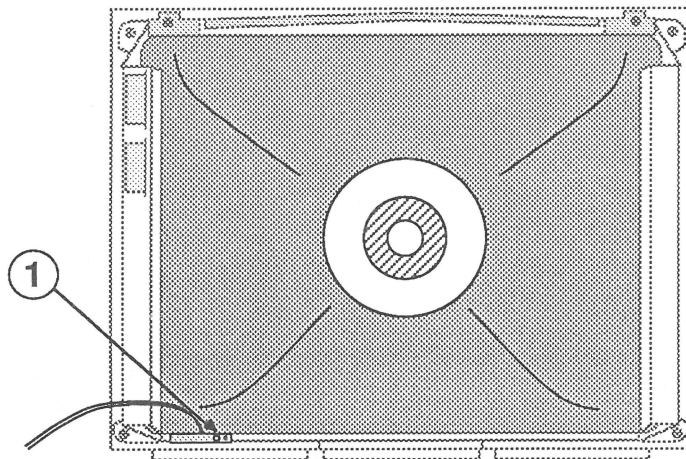


FIGURE 41

7. Remove the screw (Figure 41, #1) that secures the LED assembly to the front bezel. Lift out the LED.

Replace

1. Install the LED assembly in its place in the front bezel and replace the screw (Figure 41, #1). Be sure to line up the holes on the LED board with the guide tabs provided on the bezel.

2. Replace the chassis frame.
3. Replace the anode cap.
4. Replace the EMI shield.
5. Replace the cover.

AppleColor High-Res RGB Monitor

Section 3 – Adjustments

□ CONTENTS

3.2	Introduction
3.2	Safety Instructions
3.3	Location of Controls
3.3	User Controls
3.3	External Service Controls
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3.7	Materials Required
3.7	Horizontal Size
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3.12	White Balance
3.15	Convergence
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3.23	Jitter Correction
3.24	Materials Required
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3.26	Vertical Alignment
3.28	MacTest IICx/IICi Test Patterns
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3.28	Generating the Test Patterns

□ INTRODUCTION

After you replace any module, evaluate the text, graphics, and color production of the monitor using any software that produces text, graphics, and/or color.

All yoke adjustments have been set by the manufacturer. Do not attempt any tilt or ring adjustments on the AppleColor High-Res RGB Monitor.

If the following procedures do not correct the monitor's adjustment problems, isolate the faulty module (see Section 4, Troubleshooting) and return it to Apple.

□ SAFETY INSTRUCTIONS

WARNING: *There are high voltages and a high-vacuum picture tube inside the AppleColor High-Res RGB Monitor. To prevent serious injury, learn all safety precautions in Section 1, Basics, before you proceed!*

In addition to following all safety precautions in the Basics section, be sure to:

- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with your other hand.
- Use a mirror for viewing adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to the back of the monitor to rotate the controls—you cannot see what you are about to touch!
- Perform only those adjustments that are absolutely necessary. Do not attempt to make any adjustments other than the ones explained in this section, and do those with extreme caution.

□ LOCATION OF CONTROLS

User Controls

The BRIGHTNESS control (Figure 1, #1) and the CONTRAST control (Figure 1, #2) are located on the side of the monitor's case and are accessible to the user.

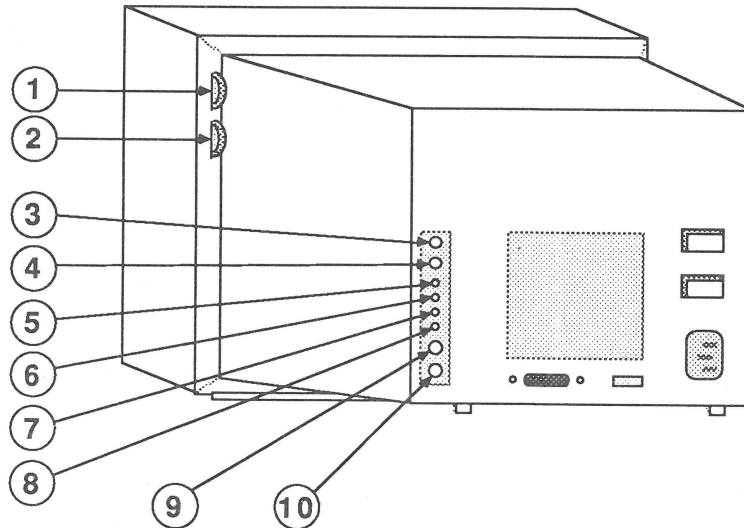


FIGURE 1

External Service Controls

The following service adjustment controls are located on board "B," but are accessible from the outside through a panel on the back case:

- CUTOFF (Figure 1, #3; this adjustment is not accessible externally on newer units)
- FOCUS (Figure 1, #4)
- HORIZONTAL SIZE or WIDTH (Figure 1, #5)
- HORIZONTAL SHIFT or CENTER (Figure 1, #6)
- VERTICAL SIZE or HEIGHT (Figure 1, #7)
- VERTICAL SHIFT or CENTER (Figure 1, #8)
- VERTICAL STATIC CONVERGENCE (Figure 1, #9)
- HORIZONTAL STATIC CONVERGENCE (Figure 1, #10)

The HORIZONTAL SHIFT (Figure 1, #6) and VERTICAL SHIFT (Figure 1, #8) controls are preset at the factory and normally do not need readjusting.

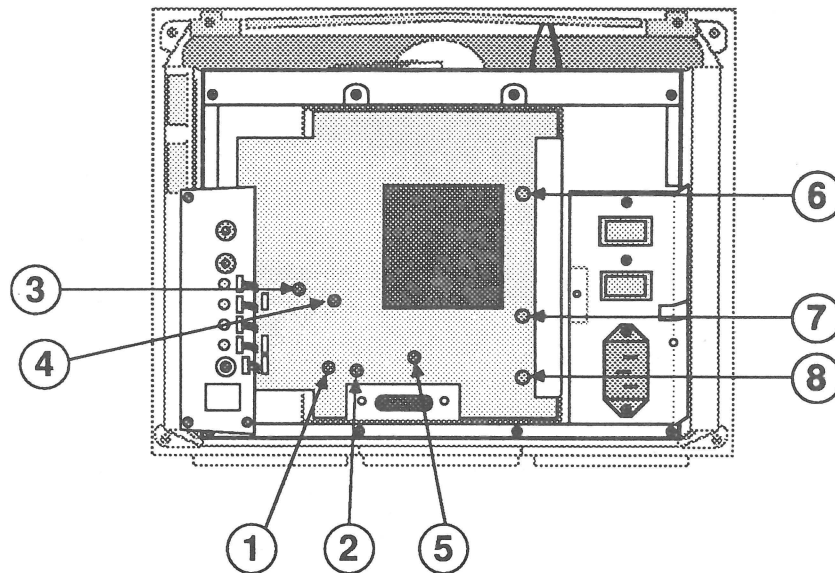


FIGURE 2

Internal Service Controls

The remaining video controls, including the color adjustment controls, are located on the "B" board inside the monitor and can be accessed only after removing the monitor cover, EMI shield, and metal video board shield.

Small yellow adjustment pots:

- SUB-BRIGHTNESS (Figure 2, #1)
- SUBCONTRAST (Figure 2, #2)
- RED DRIVE (Figure 2, #3)
- GREEN DRIVE (Figure 2, #4)
- BLUE DRIVE (Figure 2, #5)

Large blue adjustment pots:

- BLUE BACKGROUND or BLUE BIAS (Figure 2, #6)
- GREEN BACKGROUND or GREEN BIAS (Figure 2, #7)
- RED BACKGROUND or RED BIAS (Figure 2, #8)

□ MACTEST II/IIX TEST PATTERNS

Use the following procedure to display test patterns on a High-Res RGB Monitor connected to a Macintosh II or Macintosh IIX computer. Refer to "MacTest IICx/IICi Test Patterns" in this section to display test patterns using a Macintosh IICx or Macintosh IICi and the *MacTest™ IICx/IICi* diagnostic.


MacTest II/IIX tests the video RAM on the video card and displays test patterns used to adjust the monitor. *MacTest II/IIX* does not diagnose monitor problems; to diagnose monitor problems, refer to Troubleshooting.

Materials Required

Macintosh II or Macintosh IIX
Macintosh II Video Card
MacTest II/IIX diagnostic disk

Generating the Test Patterns

Follow the steps below to test the video RAM and display the monitor test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh II or Macintosh IIX computer.
2. Boot the *MacTest II/IIX* disk from Drive 1 (the right-side drive).
3. *MacTest II/IIX* will display a window instructing you to turn off the system and connect a SCSI loopback card. Unless you wish to test the logic board, click **OK** to get to the Start window.
4. When the Start window appears on the screen, go to the  menu and open the Control Panel.
5. Click the Monitors icon.
6. In the box called **Colors** (it may be called **Grays**, if **Grays** is selected), select the highest number available.
7. Check the monitor icons at the bottom of the panel. If more than one monitor is connected to the Macintosh II/IIX, make sure the menu bar is on the RGB monitor icon. If necessary, drag the menu bar to the icon of the RGB monitor.

8. Close the Control Panel window to return to the Start window.

Note: If you selected a new main monitor, you must restart *MacTest II/Ix* in order for this change to take effect. Quit, and then reboot *MacTest II/Ix*.

9. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect the default Logic and Disk Drives tests by clicking their selection boxes once.
10. If you want to test video RAM on the video card, click **Video Card in slot**.
11. Click **Video monitor** to display the video adjustment test patterns and click **OK** to close the Test Selections window.
12. When the Start window reappears, click **Start**.

Note: If you selected the video card RAM test, this message will appear: **Testing Macintosh Video Card**. Horizontal and vertical lines will flash across the screen. After about one minute the Start window will reappear, and the Status line will indicate whether the video card has passed or failed the test.

13. *MacTest II/Ix* will display a window telling you how to change the main monitor (if necessary). Click **OK** to display the first test pattern.

Note: Click the mouse to advance to the test pattern you want. Each test pattern is displayed once. When you have advanced through the test patterns, you will be returned to the Start window. To redisplay the test patterns, click **Start**.

14. *MacTest II/Ix* displays the following test patterns:
 - Gray Bars
 - Color Bars (displayed only if **Colors** is selected)
 - Full White Screen
 - Full Black Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

□ ADJUSTMENT PROCEDURES

Materials Required

Plastic adjustment tool ("tweaker") or insulated screwdriver
Voltmeter
Light meter (Sekonic Multi-Lumi, model L-248)
Mirror
Flexible metric ruler

Horizontal Size

1. Display the **Crosshatch II (white background)** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the HORIZONTAL SIZE control (Figure 3, #1) until the raster is 235 mm wide.

Note: To measure the raster width, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the left edge of the raster, keeping your eye perpendicular to the zero mark. Holding the ruler in exactly that position, move your head so that your eye is perpendicular to the right edge of the raster, and note the ruler measurement. Adjust the HORIZONTAL SIZE control, if necessary, until the width of the raster is 235 mm.

IMPORTANT: Always adjust the horizontal size before you adjust the vertical size. The horizontal adjustment can affect the height of the raster.

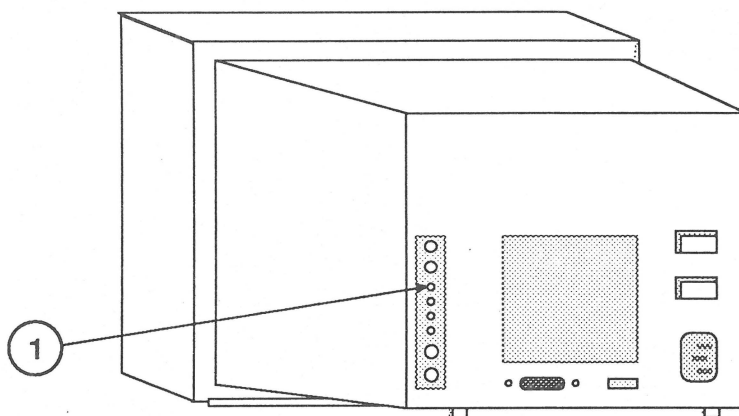


FIGURE 3

Vertical Size

After adjusting the horizontal size, adjust the vertical size:

1. Display the **Crosshatch II (white background)** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the VERTICAL SIZE control (Figure 4, #1) until the raster is 176 mm high.

Note: To measure the raster height, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the top edge of the raster, keeping your eye perpendicular to the zero mark. Holding the ruler in exactly that position, move your head so that your eye is perpendicular to the bottom of the raster, and note the ruler measurement. Adjust the VERTICAL SIZE control, if necessary, until the height of the raster is 176 mm.

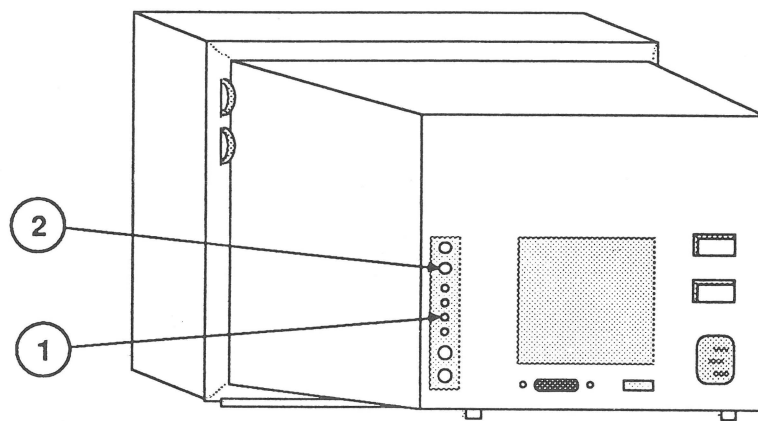


FIGURE 4

Focus

1. Display the **Focus** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the FOCUS control (Figure 4, #2) for maximum clarity at a position **halfway between the center and the side edge of the screen.**

IMPORTANT: Perform the cutoff and white balance adjustments in a dimly lit room after the monitor has been on for at least 10 minutes.

Cutoff

Perform the cutoff adjustment procedure whenever you replace the CRT assembly, the "D" board, or the video color board assembly. To adjust the cutoff, you must remove the monitor cover and metal video board shield (see Section 2, Take-Apart).

1. Turn the power off and remove the video cable from the back of the monitor. Then turn the power on, and let the monitor warm up for at least 10 minutes.

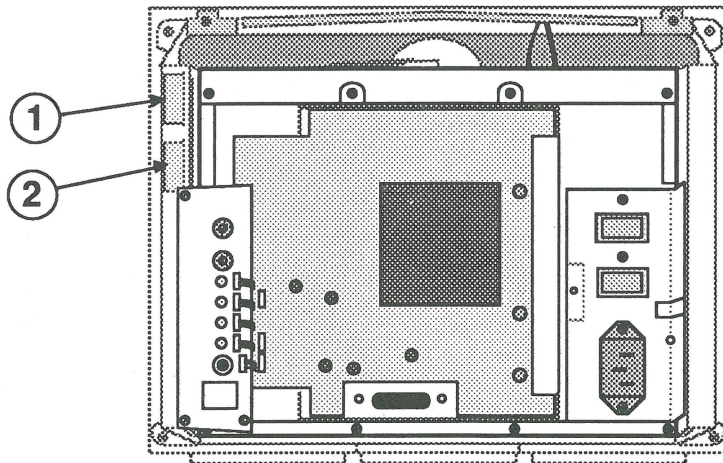


FIGURE 5

2. Set the BRIGHTNESS control (Figure 5, #1) at its center click ("detent") position. To find the detent position, turn the knob fully clockwise, then counterclockwise. The place in the middle, where the knob hesitates, is the detent position.
3. Set the CONTRAST control (Figure 5, #2) at maximum (full clockwise).

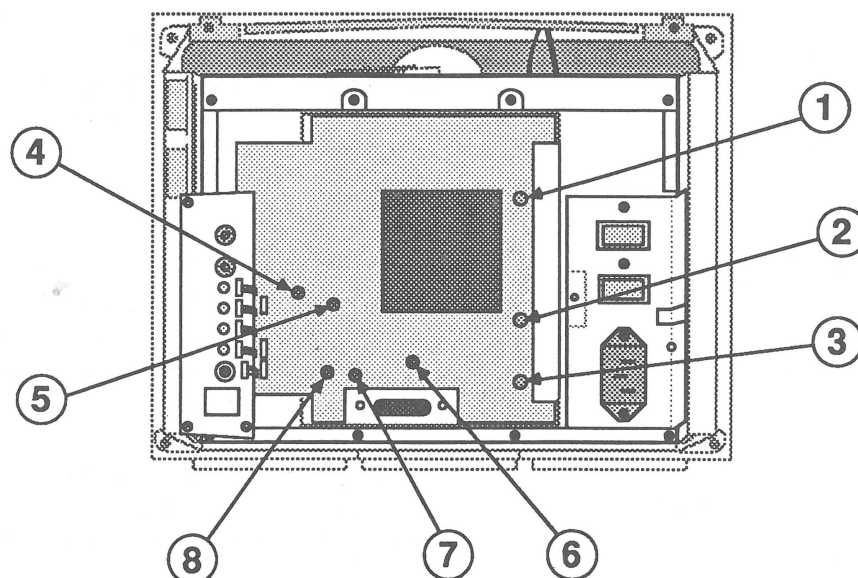


FIGURE 6

4. Using the insulated screwdriver or tweaker, set these eight controls on the "B" board at midrange:

- B.BKG (Figure 6, #1)
- G.BKG (Figure 6, #2)
- R.BKG (Figure 6, #3)
- R.DRIVE (Figure 6, #4)
- G.DRIVE (Figure 6, #5)
- B.DRIVE (Figure 6, #6)
- SUB CONT (Figure 6, #7)
- SUB BRT (Figure 6, #8)

Note: In the videotape *CRT Safety and Adjustments* the 3 background (BKG) controls (Figure 6, #1–#3) are preset to minimum (full clockwise). This is also an acceptable starting point for adjusting the cutoff.

5. Set up a voltmeter to measure DC voltage of 140V. Attach the voltmeter ground lead (black lead) to the monitor chassis.
6. Using the voltmeter red lead, measure the voltage at the cathode marked KR on the "C" board (Figure 7, #1). Gradually adjust the **red background** (R.BKG) control (Figure 7, #4) until the DC voltage at KR measures 140V (+/- 2V).
7. In the same way, measure the voltage at the cathode marked KG on the "C" board (Figure 7, #2). Gradually adjust the **green background** (G.BKG) control (Figure 7, #5) until the DC voltage at KG measures 140V (+/- 2V).

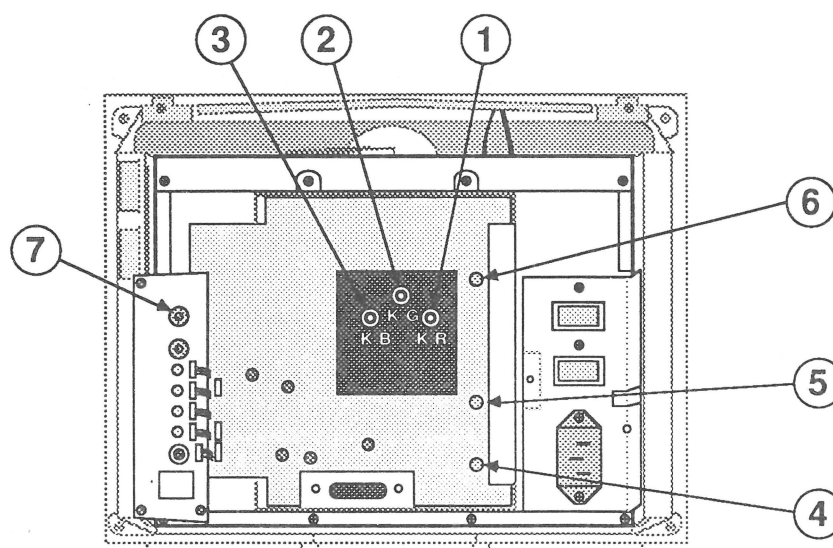


FIGURE 7

8. Finally, measure the voltage at the cathode marked KB on the "C" board (Figure 7, #3). Gradually adjust the **blue background** (B.BKG) control (Figure 7, #6) until the DC voltage at KB measures 140V (+/- 2V).

Note: If the CUTOFF control is turned up (clockwise) too far, the monitor may shut down. If this happens, turn the monitor off and the CUTOFF control all the way down (counterclockwise), and wait 30 seconds. Then turn on the monitor and resume the adjustment.

9. Turn the CUTOFF control on the "H" board (Figure 7, #7) clockwise until the screen raster is just visible, and then counterclockwise until the raster (just) disappears completely. The cutoff is now correctly set.

Note: If the cutoff cannot be set properly, stop the adjustment procedure. The monitor must be repaired.

CAUTION: Once the CUTOFF control on the "H" board is set, it should not be moved again unless all of the above steps are repeated. The life of the picture tube may be severely reduced if this adjustment is not made correctly.

10. Perform the white balance adjustments.

White Balance

Perform the following white balance adjustments whenever the CRT assembly, "D" board, or video color board assembly has been replaced.

1. **Make sure the cutoff control is properly set before you proceed!** The life of the monitor may be severely reduced if the cutoff is not set correctly. If you need to adjust the cutoff, see the preceding section.
2. If you did not have to perform the cutoff adjustments in the preceding section, you will have to preset these eight controls on the "B" board to midrange. First turn the power off and remove the video cable.

- B.BKG (Figure 8, #1)
- G.BKG (Figure 8, #2)
- R.BKG (Figure 8, #3)
- R.DRIVE (Figure 8, #4)
- G.DRIVE (Figure 8, #5)
- B.DRIVE (Figure 8, #6)
- SUB CONT (Figure 8, #7)
- SUB BRT (Figure 8, #8)

3. Connect the video cable and turn the power on. Make sure that the monitor has been on for at least 10 minutes before you proceed. Make sure the Control Panel is set to 16 shades of gray (or higher) and is not in the color mode.
4. Display the **Gray Bars** test pattern on the monitor. Make sure the **Control Panel** is set to **16 Grays** (see "Test Patterns").

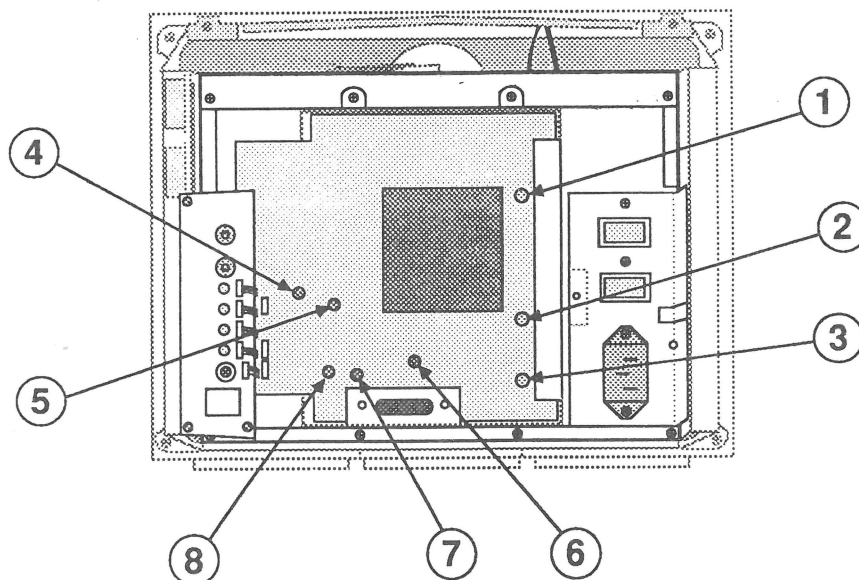


FIGURE 8

5. Alternately adjust the **background** controls—B.BKG (Figure 8, #1), G.BKG (#2), and R.BKG (#3)—so that:
- There is no predominant color (no colored tint) in the left three bars (see Figure 9).** To achieve good color balance (tracking), try adjusting down the **background** control of the predominant color. Then, if necessary, adjust the **background** controls of the two nonpredominant colors until there is no color visible.
 - The leftmost bar (bar 1) of the test pattern is completely black (matches the screen border), the next bar (bar 2) is barely visible, and the third bar (bar 3) is a dark gray.** Adjust all three **background** controls up or down to lighten or darken the three leftmost bars. Then readjust the **background** controls to maintain the color tracking as described in 5a, above.

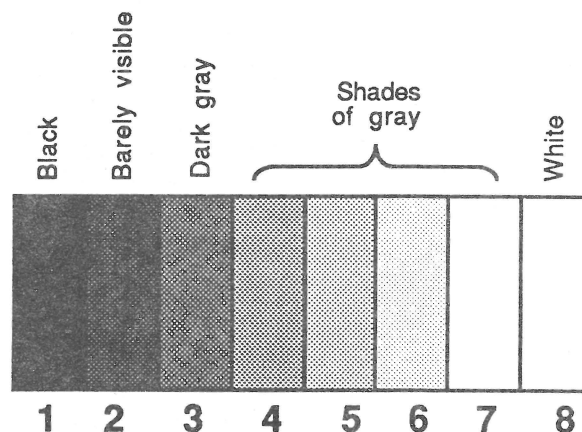


FIGURE 9

6. Now adjust the G.DRIVE control (Figure 8, #5) clockwise or counterclockwise until the brightest bar (bar 8) measures at the mid "9" scale of the light meter. Refer to "Using Light Meter To Measure Luminance" later in this section for more information.
7. Next, adjust the R.DRIVE and B.DRIVE controls (Figure 8, #4 and #6) clockwise or counterclockwise until there is no predominant color in the 3 brightest bars (bars 6, 7, 8). Repeat steps 6 and 7 as necessary.

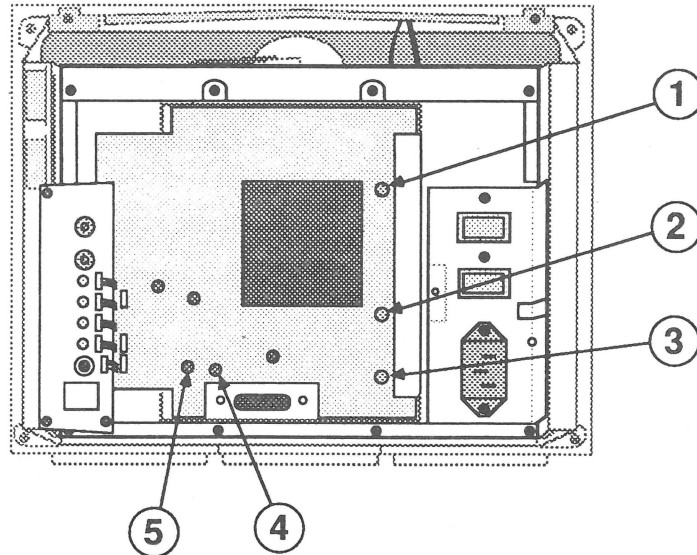


FIGURE 10

8. If the three dark bars (bars 1, 2, 3) now show a predominant color, readjust the **background** controls (Figure 10, #1, #2, or #3) of the two nonpredominant colors until only shades of black and gray are visible.

Note: The White Balance is properly adjusted if: there is no predominant color; bar 8 measures mid "9" on the light meter; and bars 1, 2, and 3 are black, barely visible, and dark gray. If additional fine tuning is required, perform steps 9 and 10.

9. Adjust the **subcontrast** (SUB CONT) control (Figure 10, #4) so that the luminance in the middle of bar 8 measures at the mid "9" scale of the light meter.
10. Adjust the **sub-brightness** (SUB BRT) control (Figure 10, #5) so that the left-most bar (bar 1) of the test pattern is completely black and the next bar (bar 2) is barely visible.
11. Exit *MacTest*, turn off monitor power, and replace the video board shield, EMI shield, and monitor cover.

Using Light Meter to Measure Luminance

Use the light meter to measure luminance as follows:

1. First, to ensure that the light meter is functioning correctly, press the red button on the back of the unit. If the reading is out of the red area, replace the battery.

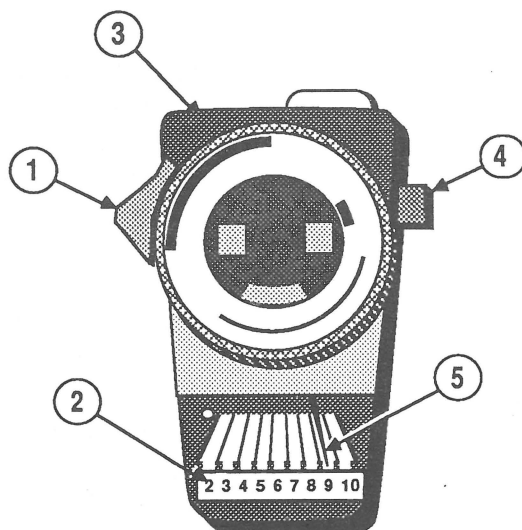


FIGURE 11

2. Next, move the side switch (Figure 11, #1) to its lower position so that the lower scale (Figure 11, #2) reads 2 through 10.
3. Then uncover the lens of the light meter (Figure 11, #3). Place the lens against the screen exactly over the brightest (8th) bar, and press the "read" button (Figure 11, #4). The reading should fall in the middle of the "9" scale (Figure 11, #5).

Convergence

If the monitor's red, blue, and green color beams are not aligned properly, the images on the screen may be shadowed or out of focus. The following color convergence adjustment is described in detail in the *AppleColor High-Resolution RGB Monitor Owner's Guide*.

Note: In most cases, the color convergence can be adjusted from the exterior service panel; it is not necessary to remove the monitor cover.

CAUTION: This adjustment differs from geometric convergence, which is a factory adjustment of the magnets on the yoke of the CRT. **Do not attempt to set convergence by tampering with the yoke magnets!**

1. Display the **Crosshatch I (black background)** test pattern on the monitor (see "Test Patterns").

2. Allow the monitor to warm up for 15 to 20 minutes.
3. Check the crosshatch lines on the convergence test pattern for the following conditions:
 - If the lines are pure white, the monitor's color convergence does not need adjusting. Exit MacTest II and power off the monitor.
 - If the lines show any colored shadows at the edges, go to the next step.

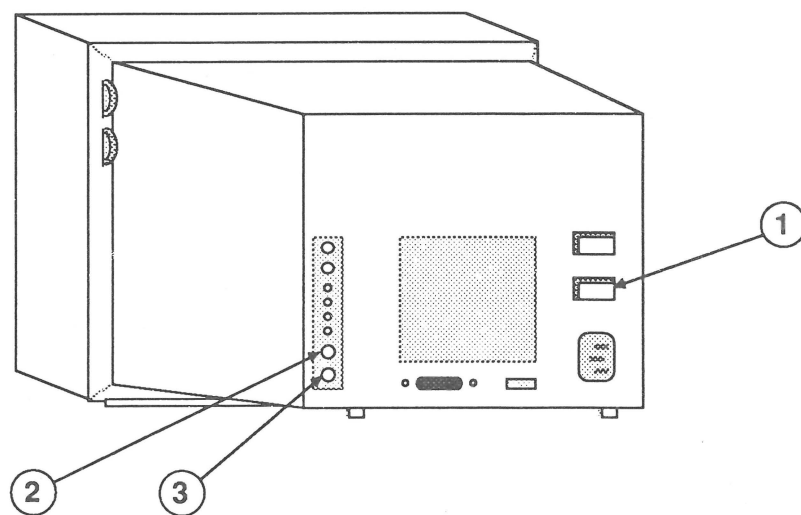


FIGURE 12

4. Press the degauss switch (Figure 12, #1), and remove the service panel cover.
5. Turn the VERTICAL STATIC CONVERGENCE (V-STAT) control (Figure 12, #2) until the color-shadowed horizontal lines of the pattern blend to solid white lines.
6. Turn the HORIZONTAL STATIC CONVERGENCE (H-STAT) control (Figure 12, #3) until the color-shadowed vertical lines of the pattern blend to solid white lines.

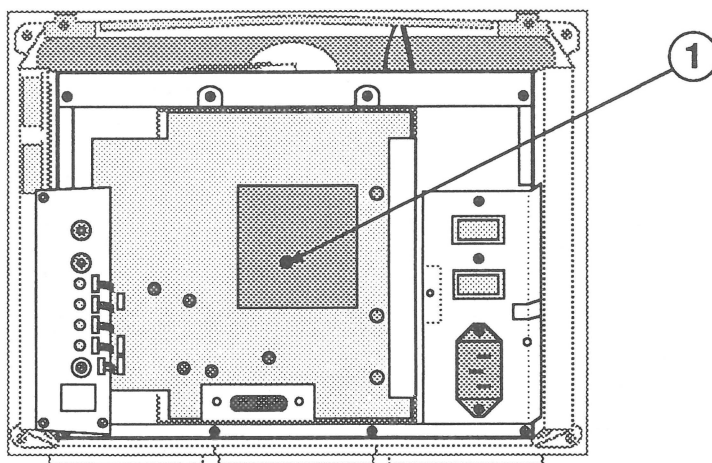


FIGURE 13

IMPORTANT: Perform the following steps only if horizontal convergence could not be adjusted using the HORIZONTAL STATIC CONVERGENCE (H-STAT) control (Figure 12, #3).

7. If you could not adjust horizontal convergence in the previous step, turn off monitor power and remove the monitor cover, the EMI shield, and the metal video board shield. Then locate the other H-STAT control (Figure 13, #1) beneath the plastic cover on video board "C." Insert an insulated screwdriver or tweaker through the access hole in the plastic cover, and turn the H-STAT control until the color-shadowed vertical lines of the pattern blend to solid white lines.

If the lines on the convergence test pattern are pure white, exit *MacTest*, turn off monitor power, and replace all shields and the monitor cover. If the horizontal lines at the top or bottom of the monitor continue to show color shadows, go to the next step.

IMPORTANT: Perform the following steps only if the monitor's color convergence could not be adjusted in steps 1-7.

8. Turn on monitor power and display the **Crosshatch** pattern (see "Test Patterns").
9. Allow the monitor to warm up for 15 to 20 minutes.

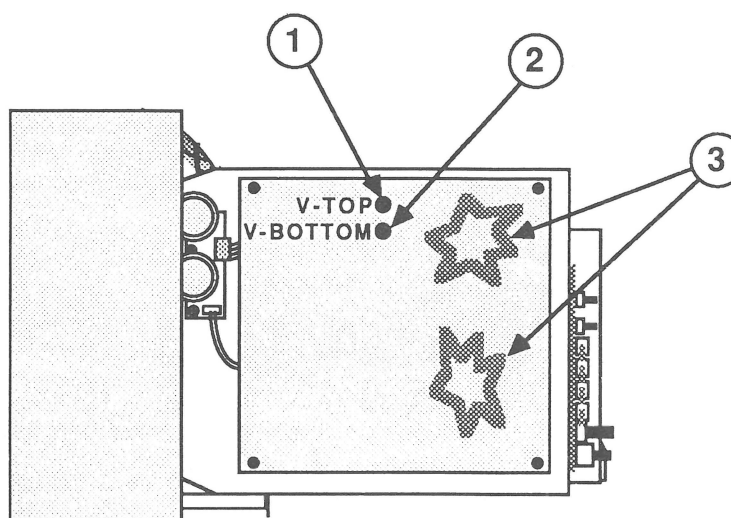


FIGURE 14

WARNING: In addition to following the standard safety precautions outlined in Section 1, Basics, take care to avoid high voltage areas on the solder side of main logic board "D." In particular, avoid the very high voltage areas outlined above in Figure 14, #3.

10. If the horizontal lines at the top of the monitor are out of adjustment, turn the V-TOP (RV518) control (Figure 14, #1) until the color-shadowed lines blend to solid white lines.
11. If the horizontal lines at the bottom of the monitor are out of adjustment, turn the V-BOTTOM (RV517) control (Figure 14, #2) until the color-shadowed lines blend to solid white lines.
12. Turn the monitor power off and replace the metal video board shield, EMI shield, and monitor cover. (See Section 2, Take-Apart.)

Geometric Distortion

Execute the following geometric adjustments only if attempts to adjust raster distortions with the external controls do not produce the desired results.

WARNING: In addition to following the standard safety precautions outlined in Section 1, Basics, take care to avoid high-voltage areas on the solder side of main logic board "D." In particular, avoid the areas of very high voltage outlined below in Figure 15, #1.

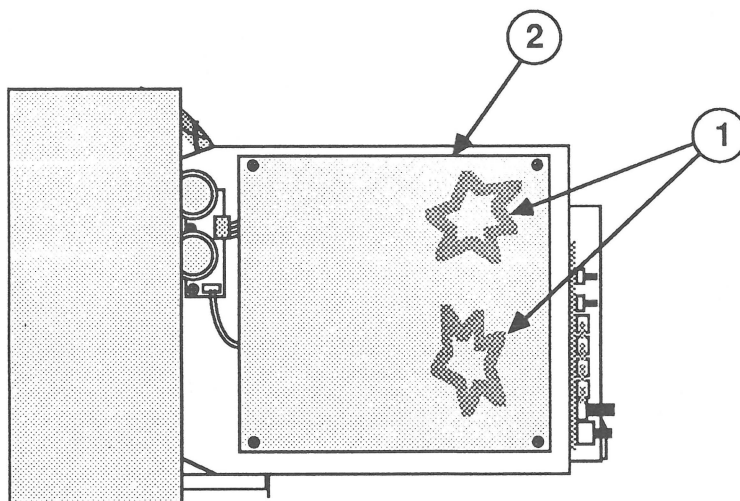


FIGURE 15

1. Remove the monitor cover and the EMI shield. (See Section 2, Take-Apart.)
2. Place the monitor so that you can see main logic board "D" (Figure 15, #2).
3. Connect the video cable of the monitor to the video expansion card of the Macintosh II. Connect the monitor power cord to the power outlet on the Macintosh II, and switch on the system.
4. Display either **Crosshatch I** or **II** test pattern on the monitor (see "Test Patterns").

5. Observe the grid of the crosshatch pattern. Make sure the boxes on the top row are the same size as the boxes on the bottom row; also make sure the boxes on the left side are the same as the boxes on the right side.

Compare the display with the distortions shown in Figure 16. Locate the appropriate pot on Figure 17, and perform the adjustment from the following instructions:

Insert the alignment tool with insulated metal tip through the access hole on main logic board "D" and into the appropriate pot. Turn the pot **slowly**. Turning the pot in the wrong direction will make the distortion considerably worse, whereas turning the pot in the proper direction should correct the problem.

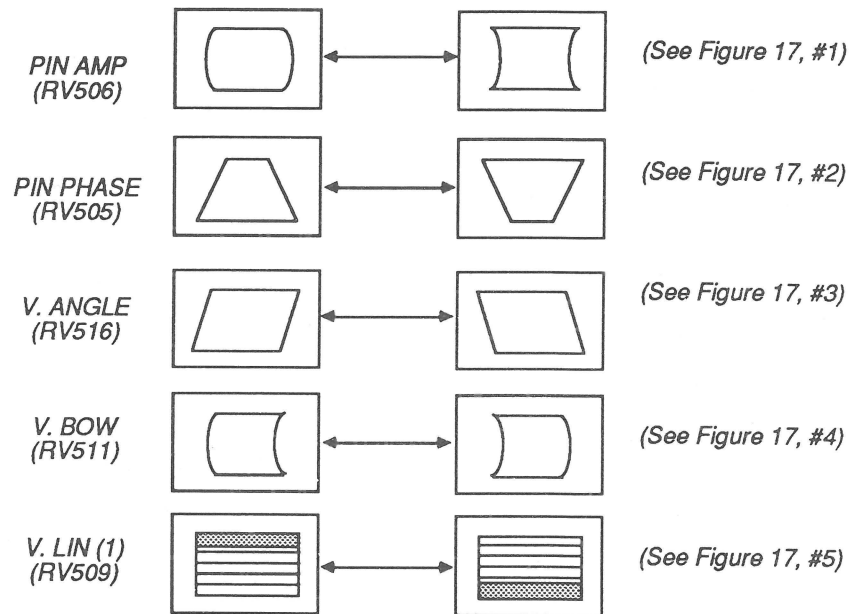


FIGURE 16

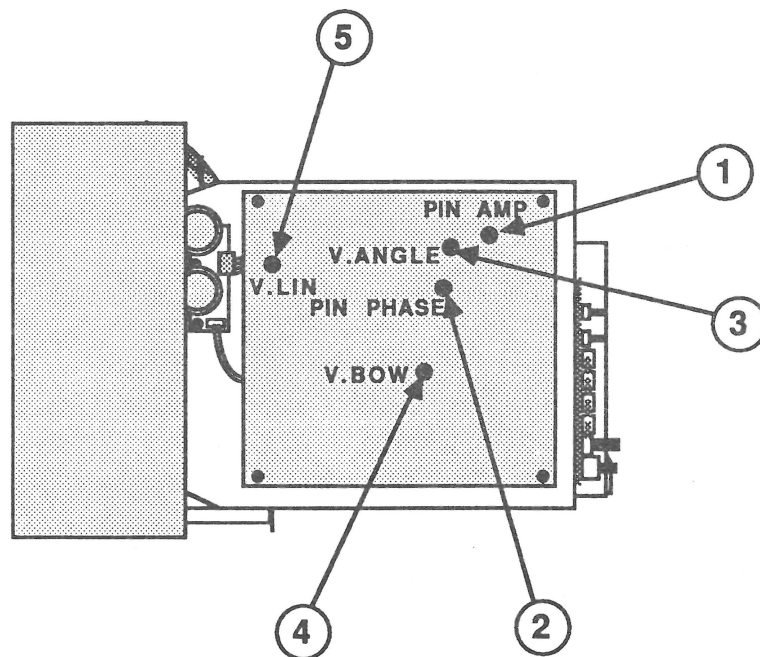


FIGURE 17

If the display is so distorted that you are unable to tell which adjustment should be made, perform the adjustments in the following sequence:

- PIN AMP
- PIN PHASE
- V. ANGLE
- V. BOW
- Repeat V. ANGLE
- Repeat PIN PHASE

If you are unable to bring the raster back to "no distortion" or "the least possible distortion," power off the monitor, remove the power cord, and replace main logic board "D."

6. Power off the monitor, remove the power cord, and replace the EMI shield and monitor cover. (See Section 2, Take-Apart.)

□ JITTER CORRECTION

Some AppleColor High-Resolution RGB monitors may exhibit a jitter problem. This jitter problem is best described as a vertical movement of the raster during which the raster alternately stretches out (becomes elongated) and shrinks (contracts). The problem may occur immediately after switching on the monitor or after the monitor has warmed up, and is often intermittent.

The jitter problem can be corrected by adding a capacitor to main logic board "D" and adjusting the vertical hold. Adjusting the vertical hold no longer requires using a frequency counter. However, the vertical hold is a sensitive adjustment that is preset at the factory and that under normal circumstances should not be touched. **Do not adjust the vertical hold yourself unless the monitor clearly exhibits the jitter problem.**

If the following procedure does not correct the jitter problem, check your solder connections. If the solder joints are OK, you will have to replace main logic board "D."

Materials Required

Medium Phillips screwdriver
Needlenose pliers
8-inch (or longer) plastic adjustment tool (insulated screwdriver)
MacTest II/IIx diagnostic disk
Small knife
Low wattage soldering iron
Alligator leads
330 μ f capacitor at 25 volts

WARNING: *In addition to following the standard safety precautions outlined in Section 1, Basics, take care to avoid the high voltage area (Figure 18, #1) of main logic board "D."*

Capacitor Installation

Perform the following steps to check the configuration of main logic board "D" and, if necessary, to install a capacitor:

1. Display the Full White Screen test pattern on the monitor (see "Test Patterns").
2. Switch off monitor power, and remove the monitor cover and EMI shield. (See Section 2, Take-Apart.)

Note: If capacitor C525 (Figure 18, #4) is not already installed on the "D" board, you will not find a label or terminal holes for it on the board.

3. Check the "D" board (Figure 18, #2) for capacitors C522 (Figure 18, #3) and C525 (Figure 18, #4).
 - a) If both capacitors are installed on the "D" board, do the Vertical Alignment procedure next.
 - b) If capacitor C522 (Figure 18, #3) is missing, do step 4 next.
 - c) If capacitor C525 (Figure 18, #4) is missing, do step 5 next.
4. Using the low wattage soldering iron and needlenose pliers, solder capacitor C522 (**0.022 μ F**) to the two holes marked C522 (Figure 18, #3) on the "D" board. Then perform the Vertical Alignment procedure.

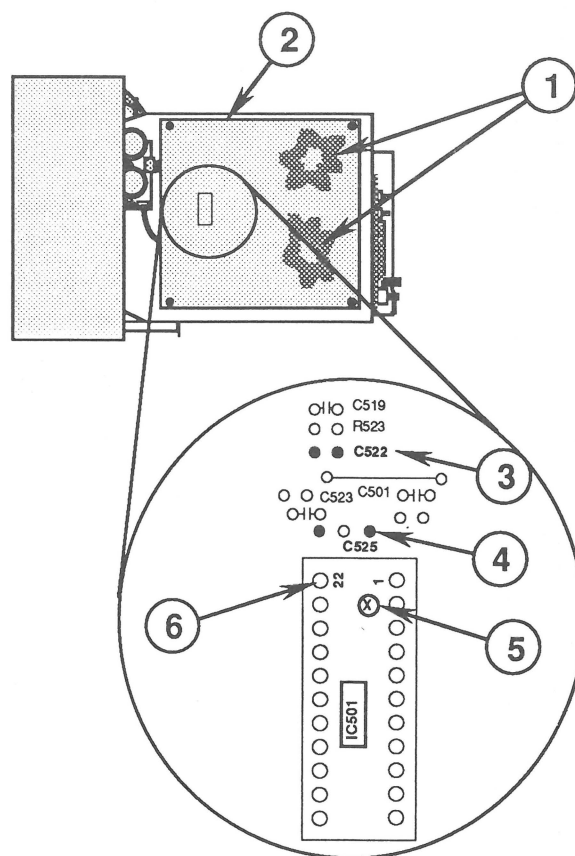


FIGURE 18

CAUTION: When installing capacitor C525 on the "D" board, be careful not to damage the printed circuit board (PCB). **Do not overheat the printed circuit board**, and scrape away only the top layer of insulating material from the surface of the PCB (leaving the copper layer intact).

5. Solder C525 ($0.047\mu\text{F}$) to the "D" board as follows:
 - a) Use a small knife to scrape away a small section of insulating material at point X (Figure 18, #5) on the solder side of the "D" board.
 - b) Place the monitor on its side. Using the soldering iron, place a small bead of solder at point X on the surface of the "D" board.
 - c) Using the needlenose pliers and soldering iron, solder capacitor C525 between IC501 pin 22 (Figure 18, #6) and point X. (For best results, lay capacitor C525 on its side and solder it to pin 22 and point X as shown in Figure 19. Be careful not to short the capacitor leads to any other solder connections.)

Vertical Alignment

Perform the following steps to adjust the vertical hold:

1. Connect an alligator lead between the negative end of the 330 μ f capacitor (Figure 19, #1) and the monitor chassis (ground).

IMPORTANT: Make sure the alligator lead does not slip off pin 22 and touch the surface of the printed circuit board. Contact with the PCB can prevent you from properly adjusting the vertical alignment.

2. Connect a second alligator lead between the positive (unmarked) end of the 330 μ f capacitor (Figure 19, #2) and pin 22 on IC501 (Figure 19, #3).

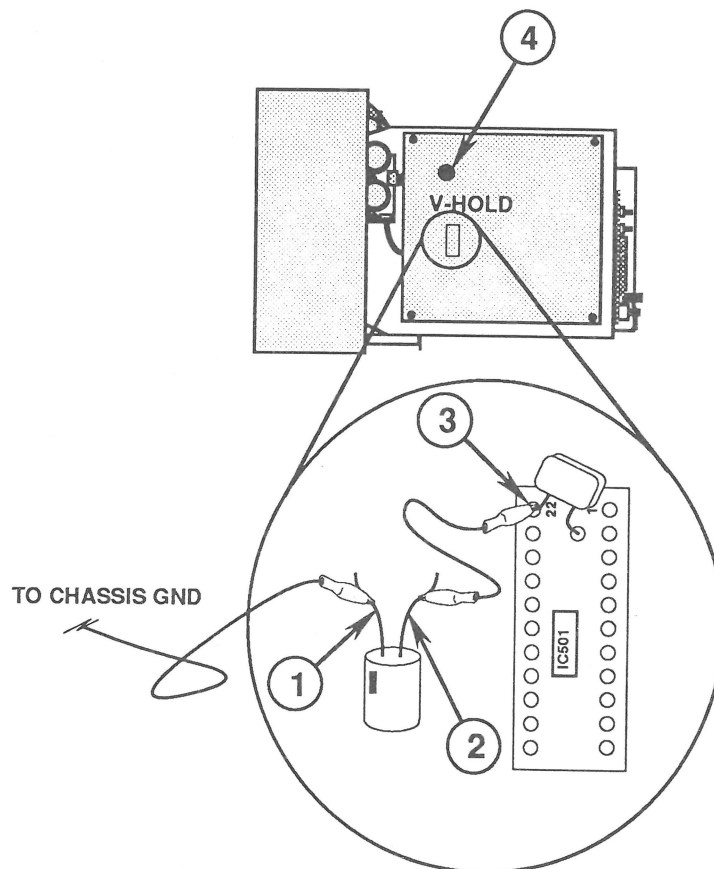


FIGURE 19

3. Connect the video cable and power cord to the monitor, and switch on monitor power.

WARNING: *To prevent serious injury when adjusting the VERTICAL HOLD control from inside the monitor, make sure that you do not touch the yoke wires, the anode wire, or the anode connector.*

WARNING: *Be sure to use the 8-inch (or longer) insulated adjustment tool when adjusting the VERTICAL HOLD control. This tool will enable you to keep your hand away from the anode wire and connector.*

4. Using the 8-inch (or longer) insulated screwdriver from inside the monitor, turn the VERTICAL HOLD (V.HOLD) control (Figure 19, #4) until 4 or 5 horizontal gray bars appear on the monitor screen.

To do this, first get a feel for the adjustment by turning the V.HOLD control its full range and watching the gray bars onscreen. The bars will revolve horizontally at varying speeds, and will reverse directions. Turn the V.HOLD control until you can see from 4 to 5 revolving bars onscreen at one time. If you are having difficulty determining how many bars are onscreen at one time, step away from the monitor and view the screen from a distance.

If you are unable to display 4 or 5 gray bars, switch off monitor power and remove the power cord, remove the 330 μ f capacitor, and check your solder connections. If the solder joints are OK, replace main logic board "D."

5. Switch off power to the monitor and remove the power cord. Then remove the 330 μ f capacitor.
6. Replace the EMI shield and the monitor cover (see Section 2, Take-Apart).

□ MACTEST IIcx/IIci TEST PATTERNS

Materials Required

Macintosh IIcx or Macintosh IIci
Macintosh II Video Card or Macintosh II High-Res Video Card (no card is required in a Macintosh IIci)
MacTest™ IIcx/IIci diagnostic disk (version 2.0 or higher)

Generating the Test Patterns

MacTest IIcx/IIci tests the video RAM on video cards installed in Macintosh IIcx or IIci computers, and also displays test patterns used to adjust the monitor. Follow the steps below to test the video RAM or display the test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh IIcx or Macintosh IIci computer.
2. Boot the *MacTest IIcx/IIci* disk.
3. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect all default test selections.

Note: Apple recommends testing the video RAM before performing the video adjustments. To test video RAM on board a Macintosh IIci computer, you must run the **Short** or **Long RAM** logic test.

4. To test the video RAM on an installed video card, click **Video Card in Slot** and enter the appropriate slot number.
5. To display the video adjustment test patterns:
 - Click **Video Monitor Connected to Built-in Video**, or
 - Click **Video Monitor Connected to Selected Card**. (Be sure that the correct video card slot is entered in the Video Card in Slot box.)
6. Click **OK** to close the Test Selections window and return to the Start window.

Note: If built-in video is being used to generate the monitor test patterns, the memory allocation for the built-in video must be set to at least 16 grays/colors. From the Apple menu, open the Control Panel, click **Monitors**, click the highest number of Colors/Grays, and close the Control Panel.

7. From the Start window, click **Start** to proceed. You will encounter one or both of these scenarios:
 - If you chose to test the Macintosh II Video Card, the following message will appear on the main (boot) monitor: **Testing Macintosh II Video Card**. Horizontal and vertical lines will flash across the screen of the RGB monitor. After about one minute, the Status line in the Start window on the main monitor will indicate whether the video card has passed the test. Clicking **Start** again will display the first test pattern (if selected) or rerun the video card test.
 - If you chose to display only the monitor test patterns, the first (gray bars) test pattern will be displayed on the Portrait Display screen. Click the mouse to advance through the test patterns (each test pattern is displayed once). When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected) and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)
8. *MacTest IIcx/IIci* displays the test patterns listed below:
 - Gray Bars
 - Color Bars
 - Full White Screen
 - Full Black Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

CUTOFF

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the cutoff adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced.

1. Turn the monitor power OFF and remove the video cable.
2. Turn the monitor power ON and let the monitor warm up for 10 minutes.
3. Preset the BRIGHTNESS control to its center "detent" position.
4. Preset the CONTRAST control to maximum (full clockwise).
5. Preset all 8 controls on the B board to midrange (the B board controls are visible in Figure 1).
6. Set up a voltmeter as shown in Figure 1.
7. Set the red cathode (test point KR on the

C board) to 140 VDC by slowly adjusting the red background (R.BKG) control on the B board.

8. Repeat the previous step for the green and blue cathodes (KG and KB) by adjusting their respective G.BKG and B.BKG controls.
9. Adjust the CUTOFF control on the H board until the raster just appears. Then back it off until the raster (just) completely disappears. If you are unable to complete this step successfully, stop the adjustment procedure because a repair is needed!

CAUTION: If the cutoff is set too high, the monitor could automatically shut down.

10. Perform the white balance adjustment on the reverse side of this card.

IMPORTANT: The CUTOFF control must not be touched again unless all the above steps are repeated. Improper cutoff adjustment will degrade monitor performance and severely reduce the life of the CRT.

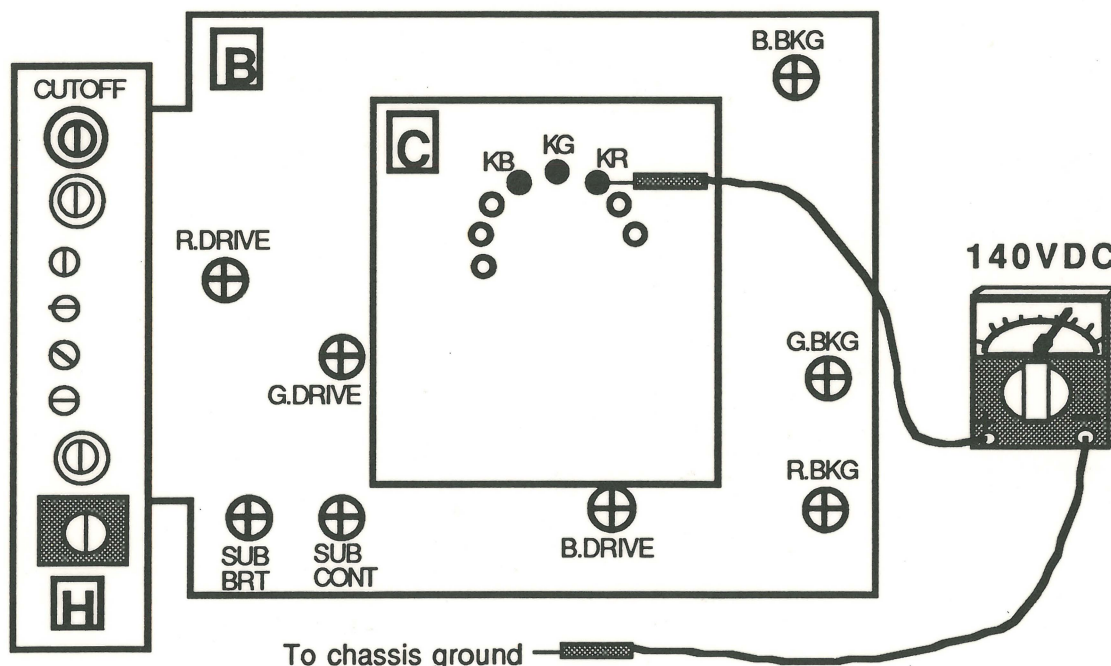


FIGURE 1

WHITE BALANCE

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the white balance adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced. The white balance adjustment should only be made when you are certain the CUTOFF control is set correctly and the monitor has been on for at least 10 minutes.

1. Turn the monitor power OFF, and remove the video cable.
2. Check that all controls are preset as shown in steps 3-5 of the cutoff adjustment procedure (over).
3. Connect the video cable, turn the monitor power ON, and let the monitor warm up for 10 minutes. Make sure that the Control Panel is set to 16 shades of gray and is not in the color mode.
4. Display the Gray Bars test pattern.
5. Alternately adjust the background controls (B.BKG, G.BKG, and R.BKG) so that:
 - Bars 1, 2, and 3 have no predominant color
 - Bar 1 is completely black (same as border)
 - Bar 2 and Bar 3 are barely visible and dark gray, respectively, as shown in Figure 2.
6. Adjust the G.DRIVE control on the B board until the center of bar 8 (the brightest bar) measures at the mid '9' scale on the light meter (see Figure 2).
7. Now adjust the R.DRIVE and B.DRIVE controls until there is no predominant color in the display. You may have to repeat steps 6 and 7.
8. Adjust the SUB CONT control until the brightness at the center of bar 8 measures at mid '9' on the light meter.
9. Display the Gray Bars and adjust the SUB BRT so that the 1st bar is completely black and the 2nd bar is barely visible.

NOTE: If there is no predominant color, bar 8 measures at mid '9' on the light meter, and bars 1-3 are adjusted as shown in Figure 2, the white balance is correct. If minor adjustments are still required, do steps 8 and 9.

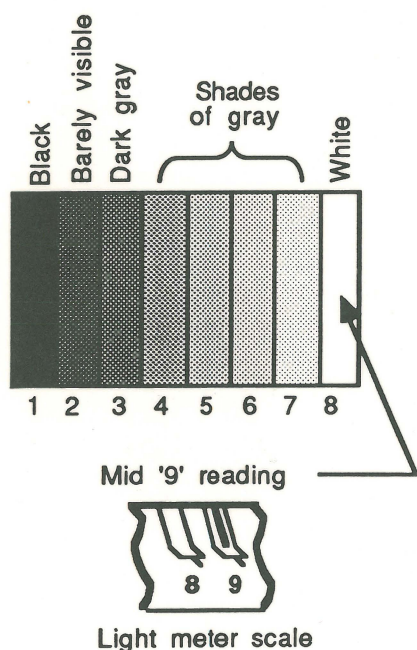


FIGURE 2

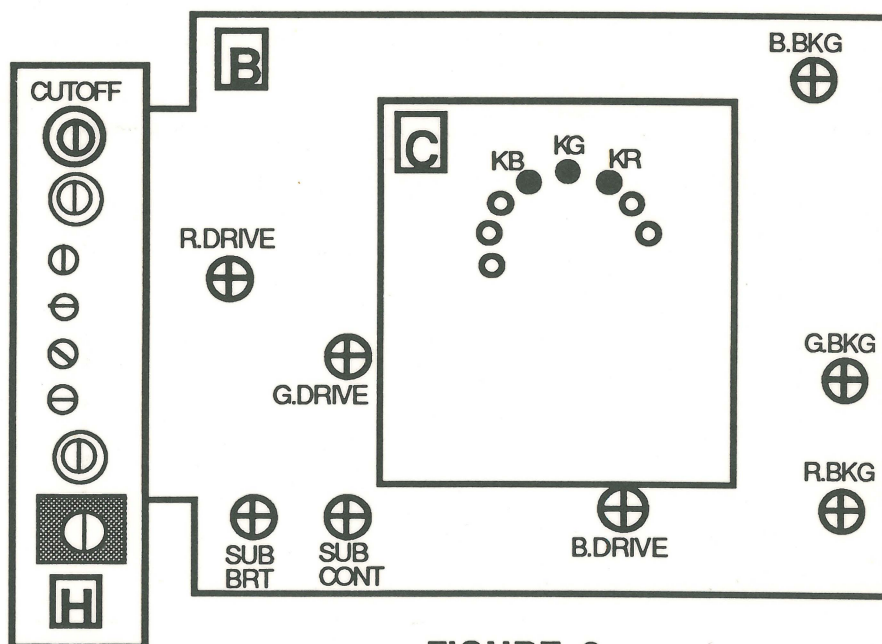


FIGURE 3

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CUTOFF

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the cutoff adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced.

1. Turn the monitor power OFF and remove the video cable.
2. Turn the monitor power ON and let the monitor warm up for 10 minutes.
3. Preset the BRIGHTNESS control to its center "detent" position.
4. Preset the CONTRAST control to maximum (full clockwise).
5. Preset all 8 controls on the B board to midrange (the B board controls are visible in Figure 1).
6. Set up a voltmeter as shown in Figure 1.
7. Set the red cathode (test point KR on the

C board) to 140 VDC by slowly adjusting the red background (R.BKG) control on the B board.

8. Repeat the previous step for the green and blue cathodes (KG and KB) by adjusting their respective G.BKG and B.BKG controls.
9. Adjust the CUTOFF control on the H board until the raster just appears. Then back it off until the raster (just) completely disappears. If you are unable to complete this step successfully, stop the adjustment procedure because a repair is needed!

CAUTION: If the cutoff is set too high, the monitor could automatically shut down.

10. Perform the white balance adjustment on the reverse side of this card.

IMPORTANT: The CUTOFF control must not be touched again unless all the above steps are repeated. Improper cutoff adjustment will degrade monitor performance and severely reduce the life of the CRT.

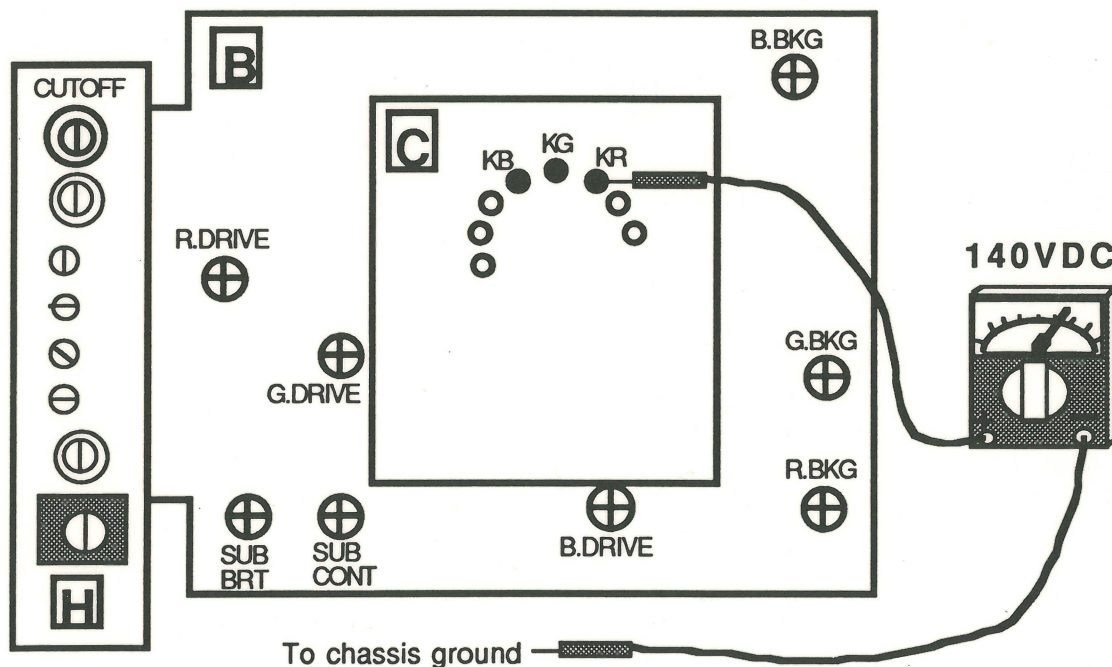


FIGURE 1

WHITE BALANCE

"Quick Reference" only: Do not use this card unless you have reviewed the monitor safety precautions and have successfully completed (at least once) the detailed color adjustment instructions given in the AppleColor™ High-Res RGB Monitor Technical Procedures.

Perform the white balance adjustment procedure whenever the CRT assembly, the "D" board, or the video color board assembly has been replaced. The white balance adjustment should only be made when you are certain the CUTOFF control is set correctly and the monitor has been on for at least 10 minutes.

1. Turn the monitor power OFF, and remove the video cable.
2. Check that all controls are preset as shown in steps 3-5 of the cutoff adjustment procedure (over).
3. Connect the video cable, turn the monitor power ON, and let the monitor warm up for 10 minutes. Make sure that the Control Panel is set to 16 shades of gray and is not in the color mode.
4. Display the Gray Bars test pattern.
5. Alternately adjust the background controls (B.BKG, G.BKG, and R.BKG) so that:
 - Bars 1, 2, and 3 have no predominant color
 - Bar 1 is completely black (same as border)
 - Bar 2 and Bar 3 are barely visible and dark gray, respectively, as shown in Figure 2.
6. Adjust the G.DRIVE control on the B board until

the center of bar 8 (the brightest bar) measures at the mid '9' scale on the light meter (see Figure 2).

7. Now adjust the R.DRIVE and B.DRIVE controls until there is no predominant color in the display. You may have to repeat steps 6 and 7.

NOTE: If there is no predominant color, bar 8 measures at mid '9' on the light meter, and bars 1-3 are adjusted as shown in Figure 2, the white balance is correct. If minor adjustments are still required, do steps 8 and 9.

8. Adjust the SUB CONT control until the brightness at the center of bar 8 measures at mid '9' on the light meter.
9. Display the Gray Bars and adjust the SUB BRT so that the 1st bar is completely black and the 2nd bar is barely visible.

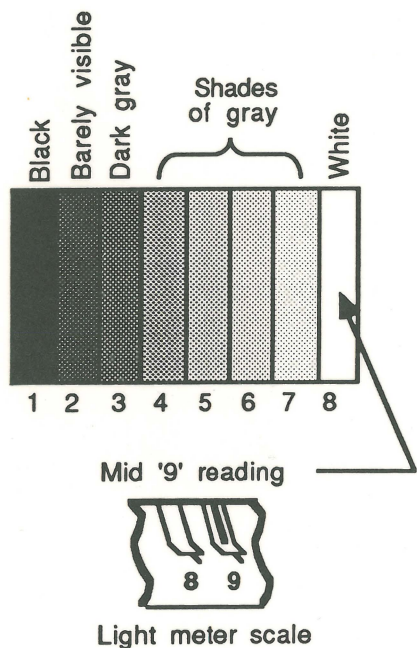


FIGURE 2

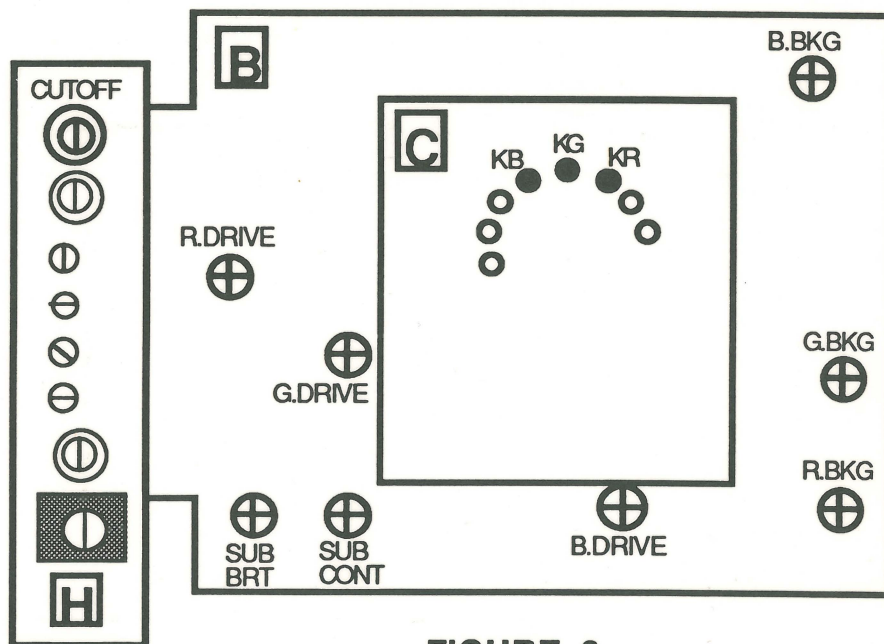


FIGURE 3

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AppleColor High-Res RGB Monitor

Section 4 – Troubleshooting

❑ CONTENTS

- 4.2 Introduction
- 4.2 Monitor Inspection
- 4.3 Symptom Chart

□ INTRODUCTION

The inspection procedure below should be performed whenever you replace a defective module in the AppleColor High-Res RGB Monitor. This procedure helps you identify common adjustment problems, and refers you to the symptom chart that follows for solutions to the problems.

The symptom chart for the AppleColor High-Res RGB Monitor lists common problems and their solutions. Find the best description of the symptom(s) your defective monitor is displaying, then try the recommended actions in the order listed. If the first corrective action does not solve the problem, put back the original module or part before you try the next action.

Monitor Inspection

Perform the following inspection whenever you replace a defective module in the AppleColor High-Res RGB Monitor. Refer to the symptom chart for a complete list of monitor problems (symptoms) and solutions.

1. Display the **Gray Bars** test pattern on the monitor. (Refer to "Test Patterns" in Section 3, Adjustments.)
2. Set the BRIGHTNESS control at its center click ("detent") position, and set the CONTRAST control at maximum (full clockwise).
3. Check that the following conditions are true:
 - Bar 1 is completely black (like the border)
 - Bar 2 is barely visible
 - Bar 8 (the white bar) measures at mid "9" on the light meter (see Section 3, Adjustments)
 - Bar display has no predominant color

If these conditions are not true, adjust the white balance or refer to the symptom chart.

4. Display the **Crosshatch** test pattern on the monitor. (Refer to "Test Patterns" in Section 3, Adjustments.)
5. Check the display for focus and geometric proportion problems. Refer to the symptom chart for a complete listing of focus and raster abnormalities.

□ SYMPTOM CHART

Problem	Solution
<ul style="list-style-type: none">• <i>No power (LED does not light)</i>	<ol style="list-style-type: none">1. Check internal power connectors.2. Check power supply fuse and replace if blown. If it blows again, go to next step.3. Replace power supply.4. Replace main logic board "D."5. Replace power switch.
<ul style="list-style-type: none">• <i>Intermittent shutdown</i>	<ol style="list-style-type: none">1. Perform cutoff adjustment procedure.2. Replace high-voltage capacitor.3. Replace main logic board "D."
<ul style="list-style-type: none">• <i>Degauss does not work (uneven patches of color)</i>	<ol style="list-style-type: none">1. Replace degauss switch.2. Replace power supply.
<ul style="list-style-type: none">• <i>Predominant red, blue, or green color tint</i>	<ol style="list-style-type: none">1. Perform white balance adjustment procedures.2. Replace main logic board "D."3. Replace video color board assembly.4. Replace CRT.
<ul style="list-style-type: none">• <i>No raster</i>	<ol style="list-style-type: none">1. Adjust external CONTRAST control.2. Ensure that all connectors are secure on power supply and main logic board "D."3. Check power supply fuse and replace if blown. If fuse blows again, go to next step.4. Replace power supply.5. Replace main logic board "D."6. Replace video color board assembly.7. Replace video board "C."8. Replace CRT.
<ul style="list-style-type: none">• <i>Raster size small/large, short/tall, narrow/wide</i>	<ol style="list-style-type: none">1. Adjust horizontal or vertical size.2. Replace main logic board "D."3. Replace CRT.

Note: When used with a Macintosh LC, the raster size of the High-Res RGB Monitor will be reduced by 3/16 inch from each side. Adjust the horizontal size.

Problem

Solution

- *Raster not centered*

1. Adjust HORIZONTAL SHIFT or VERTICAL SHIFT control (as appropriate) on board "H."
2. Replace main logic board "D."
3. Replace video color board assembly.

- *Single vertical line appears*

1. Ensure that yoke connectors are tight.
2. Replace main logic board "D."
3. Replace video color board assembly.
4. Replace CRT.

- *Single horizontal line appears*

1. Ensure that yoke connectors are tight.
2. Replace main logic board "D."
3. Replace CRT.

Note: A thin, gray, horizontal line may be visible across the bottom third of a lit screen. This line is inherent to the design of the monitor and is not a video, CPU, or video card problem. It is caused by a wire used to stabilize the vertical grid that forms the color mask. Do not replace any modules.

- *Horizontal linearity bad (screen sides differ)*

1. Replace main logic board "D."
2. Replace CRT.

- *Vertical linearity bad (screen top and bottom differ)*

1. Replace main logic board "D."
2. Replace CRT.

- *Raster size small, picture abnormally bright*

1. Ensure that yoke connectors are tight.
2. Replace main logic board "D."
3. Replace power supply.

Problem

Solution

- *Abnormal/distorted raster (other than above)*
 1. Ensure that all connectors are correctly placed and secure.
 2. Adjust geometric distortion.
 3. Replace main logic board "D."
 4. Replace video color board assembly.
 5. Replace power supply.
 6. Replace CRT.
- *Picture breaks in diagonal lines*
 - Replace main logic board "D."
- *Picture rolls vertically*
 - Replace main logic board "D."
- *Picture too dark or too bright*
 1. Adjust external BRIGHTNESS and CONTRAST controls.
 2. Set CUTOFF control on board "H" according to procedure given in Section 3, Adjustments.
 3. Adjust WHITE BALANCE.
 4. Adjust SUBCONTRAST and SUBBRIGHTNESS controls on board "B."
 5. Replace video color board assembly.
 6. Replace power supply.
 7. Replace CRT.
- *Brightness cannot be adjusted*
 1. Replace video color board assembly.
 2. Replace contrast control board "J."
- *Contrast cannot be adjusted*
 1. Replace video color board assembly.
 2. Replace contrast control board "J."
 3. Replace CRT.
- *Picture jitters or flashes*
 1. Ensure that all ground cables are secure.
 2. Ensure that adjacent computer equipment is properly grounded.
 3. Replace main logic board "D."

Problem

Solution

- *Picture jitters or vertically shrinks and stretches*

1. Perform jitter correction procedure.
2. Replace main logic board "D."

- *Black screen spots (burnt phosphor)*

- Replace CRT.

- *Out of focus**

1. Adjust FOCUS control on board "H."
2. Replace main logic board "D."
3. Replace video color board assembly.
4. Replace CRT.

- *Out of focus, with - color-shadowed characters**

1. Perform convergence adjustment procedure, then adjust FOCUS control on board "H" if necessary.
2. Replace main logic board "D."
3. Replace video color board assembly.
4. Replace CRT.

***Note:** Colors in the crosshatch pattern indicate a convergence problem. (If no colors can be seen and the display is fuzzy or the characters on the focus pattern are unclear, then the problem is focus rather than convergence.)

- *Focus cannot be adjusted*

1. Replace main logic board "D."
2. Replace video board "C."
3. Replace CRT.

- *Monitor emits high-pitched noise*

1. Replace main logic board "D."
2. Replace video color board assembly.
3. Replace power supply.

High-Res RGB Monitor

Illustrated Parts List

❑ CONTENTS

- IPL.3 CRT Assembly (Figure 1)
- IPL.5 Internal Assembly (Figure 2)

The figures and lists above include all piece parts that can be purchased separately from Apple for the High-Res RGB Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

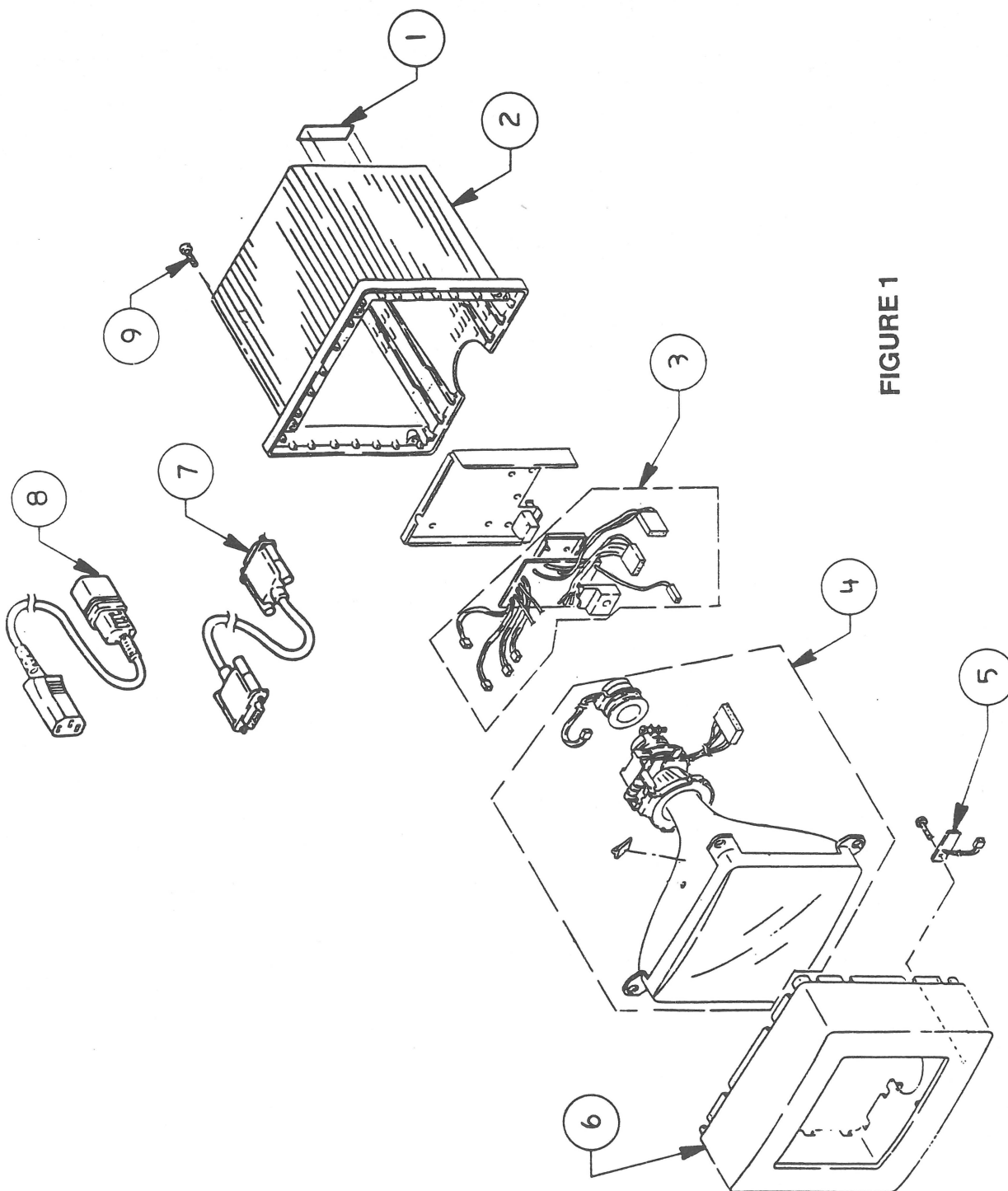


FIGURE 1

□ CRT ASSEMBLY (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	949-0127	Adjustment Panel Cover
2	949-0114	Rear Cover, Plastic
3	981-0006	Video Board "C"
4	076-0245	CRT Assembly
5	590-0439	LED Cable Assembly
6	949-0113	Bezel, Plastic Case
7	590-4161	Cable, CPU to Monitor, 1.75 M
8	590-0372	Cable, External Power, Domestic, 1.75 M
	590-0422	Cable, External Power, Europe
9	956-0007	Screw, Knob Set

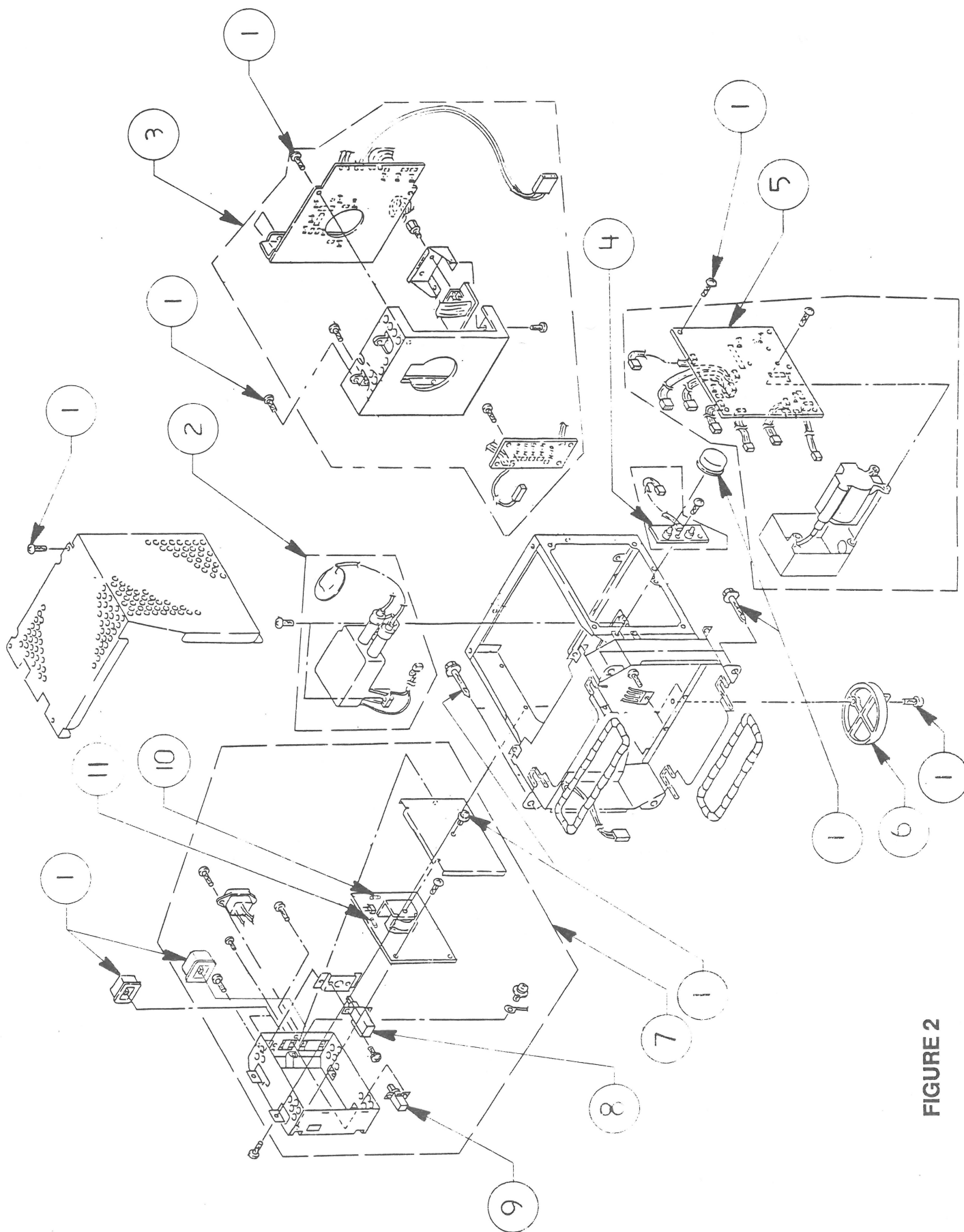


FIGURE 2

□ INTERNAL ASSEMBLY (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	956-0007	Screw, Knob Set
2	910-0058	High-Voltage Capacitor
3	661-0398	Video Color Board Assembly
4	905-0003	Contrast Control Board "J"
5	661-0399	Main Logic Board "D"
–	121-0117	Capacitor C522, 0.022 mF, 50V, Mylar
–	121-0118	Capacitor C525, 0.047 mF, 50V, Mylar
6	949-0115	Stand Attachment, Plastic Bottom
7	661-0397	Power Supply
8	937-0026	Degaussing Switch
9	937-0025	On/Off Switch
10	740-0109	Fuse, 250V, 6.3 Amp (F101)
11	740-0108	Fuse, 250V, 3.15 Amp, Medium Time-lag (F102)

Note: Capacitors C522 and C525 are available only for repairing Main Logic Board "D." Refer to "Jitter Correction" in Adjustments, Section 3, for more information regarding the use and location of these capacitors.

Apple Two-Page Monochrome Monitor

Technical Procedures

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	2.7	Discharging the Cathode-Ray Tube (CRT)
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	2.9	Anode Cap
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	2.16	Main Board
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Illustrated Parts List	IPL.3	Apple Two-Page Monochrome Monitor Assembly

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Apple Two-Page Monochrome Monitor

Section 1 – Basics

□ CONTENTS

- 1.2 Product Description
- 1.3 Two-Page Monochrome Video Card
- 1.3 Care and Handling

□ PRODUCT DESCRIPTION

The Apple® Two-Page Monochrome Monitor is a high-performance 21-inch monitor capable of displaying two full pages of text or graphics on the Macintosh® II, the Macintosh IIfx, or the Macintosh IIfx. The monitor's large screen display is ideal for CAD/CAM work, engineering or technical applications, and desktop publishing. The monitor features 1152 (horizontal) x 870 (vertical) resolution with a dot density of 78 dots per inch. The Apple Two-Page Monochrome Monitor also contains a universal power supply that can be used on all line voltages and an antiglare screen to reduce eye strain. It comes assembled with an integral tilt/swivel stand for easy desktop publishing.

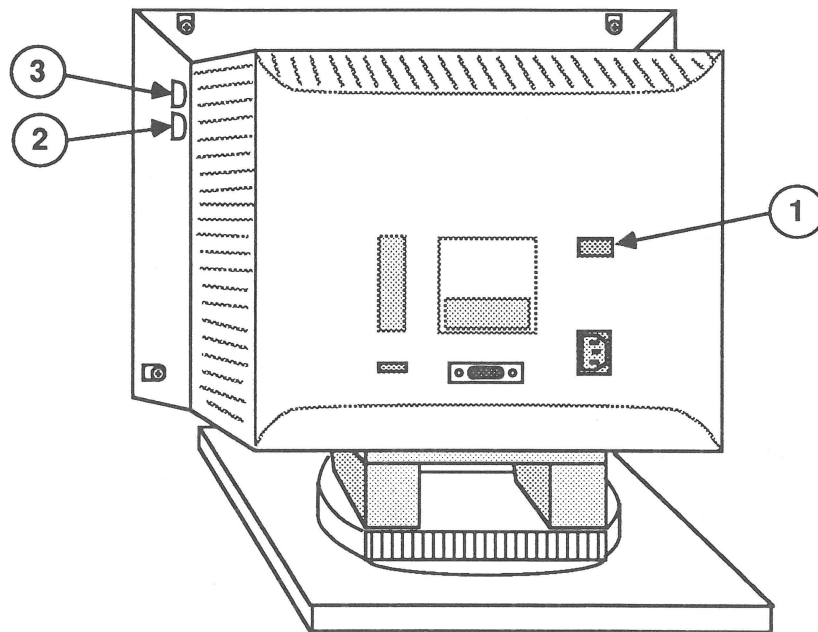


FIGURE 1

The power switch (Figure 1, #1) is located at the back of the monitor, and the contrast control (Figure 1, #2) and brightness control (Figure 1, #3) are located on the monitor's right side (as you face the monitor screen).

Two-Page Monochrome Video Card

The Apple Two-Page Monochrome Monitor must be used with the Two-Page Monochrome Video Card. The Two-Page Monochrome Video Card comes with 256K of video RAM installed, and can display 2 bits per pixel, or up to 4 shades of gray simultaneously. An expansion kit can upgrade the video card to 512K of video RAM, allowing up to 16 shades of gray to be displayed simultaneously on the monitor screen.

□ CARE AND HANDLING

The Apple Two-Page Monochrome Monitor is heavy (60 pounds approximately), so great care should be taken when lifting or moving the monitor. It is a good idea to get someone to help you whenever you plan to lift the monitor. In addition, make sure that the surface upon which you place the monitor can support its weight.

Keep service modules and finished goods monitors in the Apple packaging until use, and return modules to Apple for repair in approved module packaging.

The Apple Two-Page Monochrome Monitor contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

Apple Two-Page Monochrome Monitor

Section 2 – Take-Apart

□ CONTENTS

2.2	Monitor Tilt-Swivel Stand
2.4	Rear Cover
2.6	Access Cover
2.7	Discharging the Cathode-Ray Tube (CRT)
2.7	Discharge Procedure
2.9	Anode Cap
2.10	Video Board
2.16	Main Board
2.24	Power Supply
2.26	Fuse
2.27	On-Off Switch Filter Assembly
2.30	Contrast-Brightness Assembly
2.34	Bezel
2.36	Cathode-Ray Tube (CRT)
2.42	LED Assembly

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

□ MONITOR TILT-SWIVEL STAND

Materials Required

#2 Phillips screwdriver

IMPORTANT: You will only need to remove the Apple Two-Page Monochrome Monitor tilt-swivel stand when removing and replacing the CRT.

Remove

1. While facing the back of the monitor, tilt the monitor over on its left side.

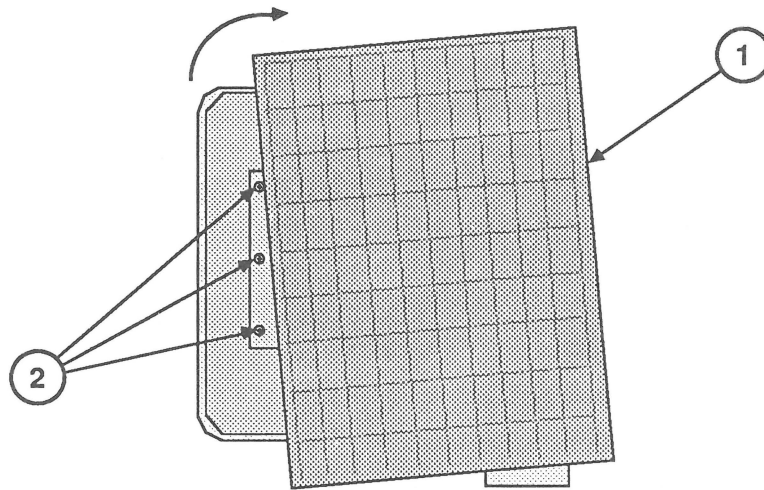


FIGURE 1

2. Slide the monitor stand forward toward the bezel.
3. While lifting the monitor up slightly with one hand, rotate the base of the stand (Figure 1, #1) upward until the three screws (Figure 1, #2) that secure the stand to the chassis can be reached.
4. Remove the three screws (Figure 1, #2).
5. Slide the monitor stand back to remove it from the chassis frame and set the monitor stand aside.
6. Carefully set the monitor upright.

Replace

1. While facing the back of the monitor, tilt the monitor over on its left side.
2. Holding the base of the monitor stand, you will notice that one end of the tilt-swivel mechanism has three screw holes (Figure 2, #1), and the other end has two plastic tabs (Figure 2, #2). Rotate the tilt-swivel mechanism until it is perpendicular to the base of the monitor stand.

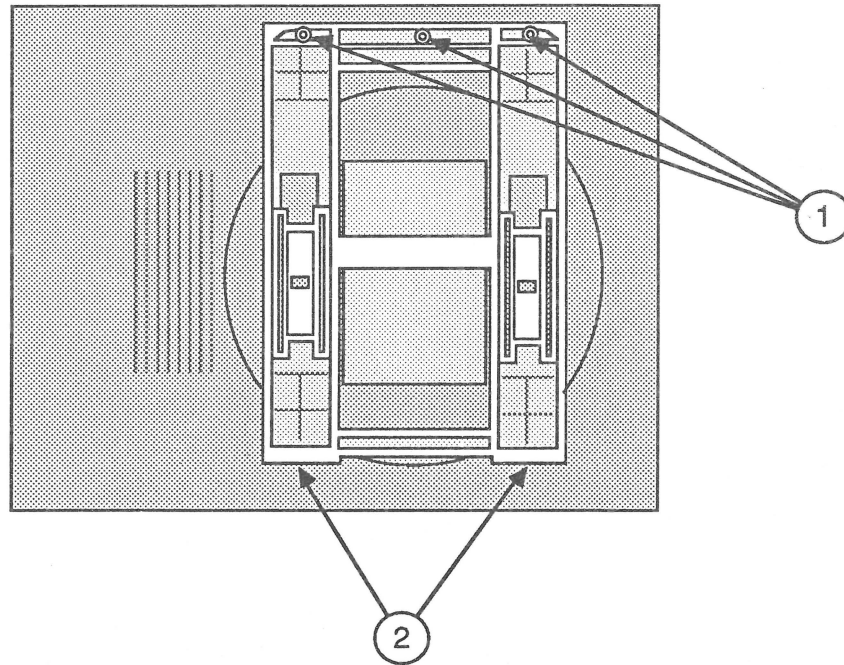


FIGURE 2

3. Slide the two plastic tabs (Figure 2, #2) on the tilt-swivel mechanism forward into the two slots on the bottom of the chassis frame.
4. Replace the three screws (Figure 1, #2) that secure the stand to the chassis frame.
5. Carefully set the monitor upright.

❑ REAR COVER

WARNING: The Apple Two-Page Monochrome Monitor contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the back cover. **Failure to follow the safety rules could result in serious injury.**

Materials Required

#2 Phillips screwdriver

Remove

1. Switch off the monitor and disconnect the AC power cord and video cable.
2. Remove the four cover screws (Figure 3, #1).

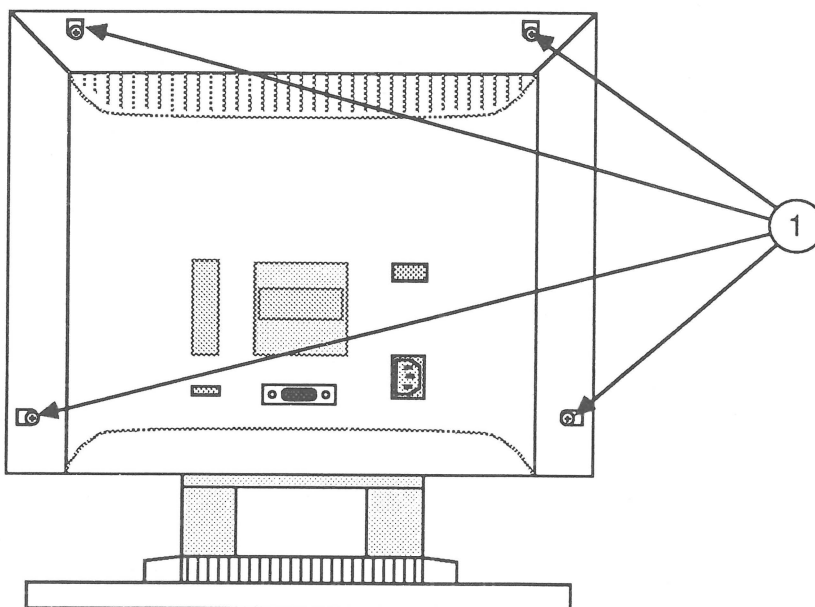


FIGURE 3

3. Slide the rear cover off the monitor chassis.

Replace

1. Slide the rear cover over the monitor chassis. Fit the "teeth" on the cover (Figure 4, #1) over the edges of the front bezel.

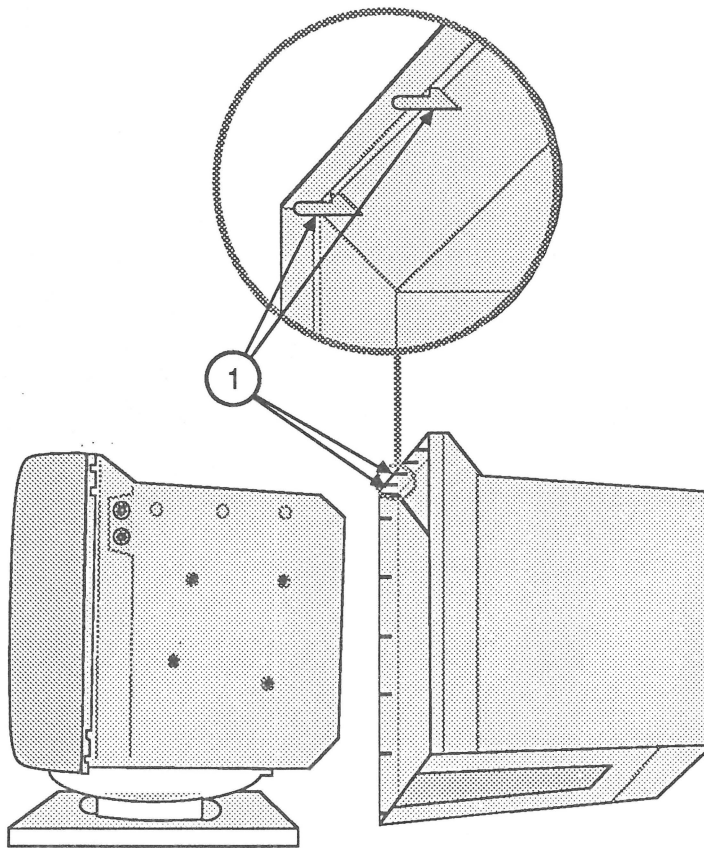


FIGURE 4

2. Replace the four cover screws (Figure 3, #1). **Be careful not to overtighten the screws!**

□ ACCESS COVER

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the rear cover.

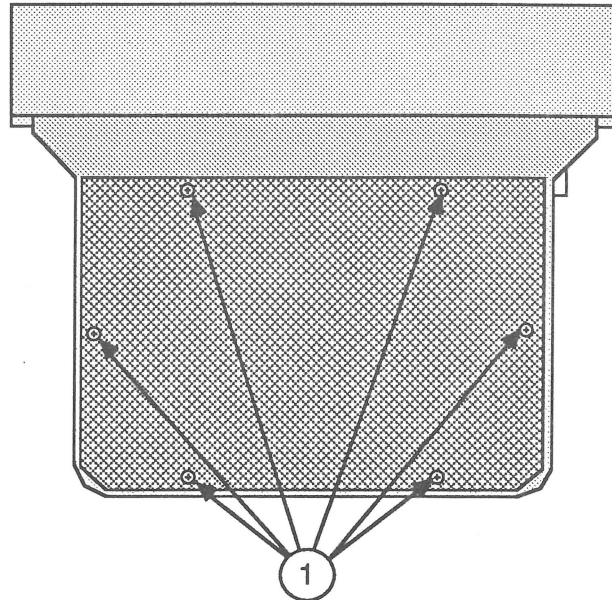


FIGURE 5

2. Remove the six screws and lockwashers (Figure 5, #1) that hold the access cover in place.
3. Lift the access cover off the chassis and set it aside.

Replace

1. Fit the access cover over the monitor chassis, matching up screw holes on the top, the bottom, and the sides.
2. Replace the six Phillips screws and lockwashers (Figure 5, #1).
3. Replace the rear cover.

□ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The Apple Two-Page Monochrome Monitor has a bleeder resistor that automatically drains the charge from the CRT when the power is off. **Follow the discharge procedure below to ensure your safety if the resistor has failed and the anode is still charged.**

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number 076-0381)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the You Oughta Know tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are also given in that section.

Discharge Procedure

1. Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!

WARNING: To prevent injury, do not touch any part of the yoke assembly (Figure 6, #1), the anode wire (Figure 6, #2), the anode connector (Figure 6, #3), the flyback transformer (Figure 6, #4), the inside of the AC power switch (Figure 6, #5), or the primary fuse (Figure 6, #6).

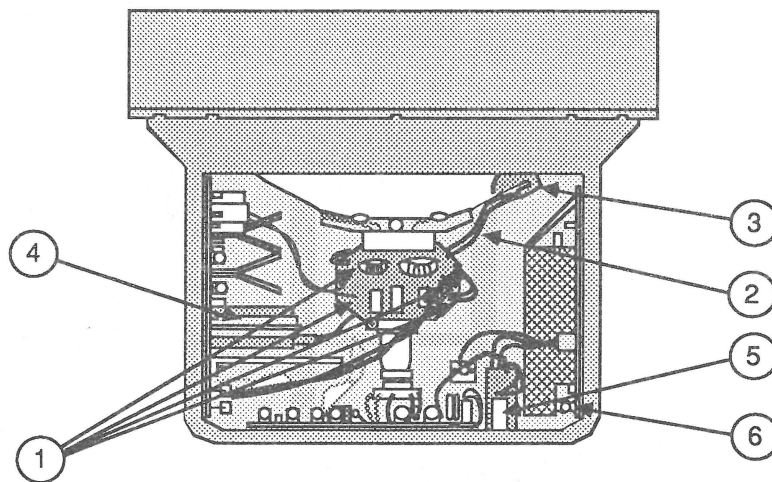


FIGURE 6

2. Remove the rear cover and the access cover.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

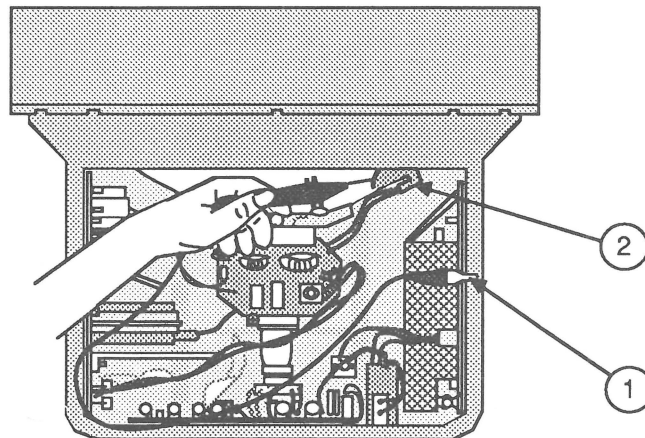


FIGURE 7

4. Attach the clip of the CRT discharge tool to the side of the chassis (Figure 7, #1).
5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 7, #2) until it touches the anode ring.
7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: If the bleeder resistor fails, a secondary charge could build up over a period of time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode aperture (Figure 8, #1).

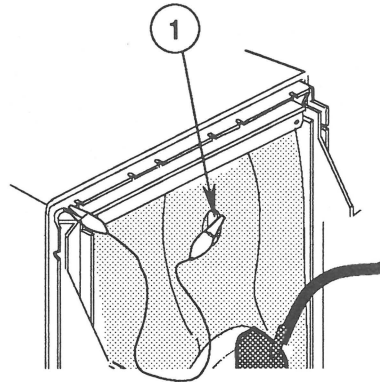


FIGURE 8

Anode Cap

For some procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector and insert it into the aperture. Press the edges of the anode cap down to ensure a firm seal, and tug on the anode wire to make sure it is firmly seated.

□ VIDEO BOARD

Materials Required

#2 Phillips screwdriver
Adjustable wrench

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT has been discharged.)
5. Detach from the video board the connectors listed in Table 1 and shown in Figure 9.

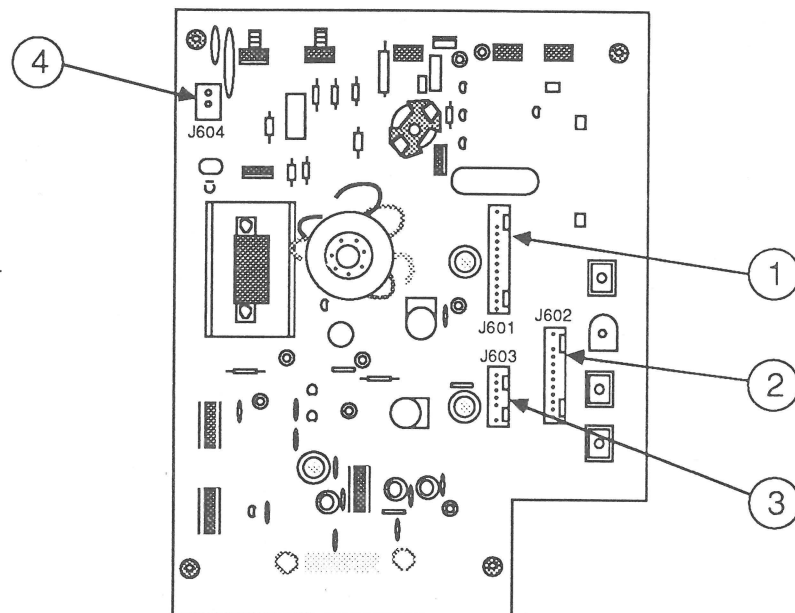


FIGURE 9

CAUTION: Do not remove the connectors by pulling on the connector cables. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

Connector	Location	No. Wires	Wire Color
J601	Figure 9, #1	13	White
J602	Figure 9, #2	11	White
J603	Figure 9, #3	6	White
J604	Figure 9, #4	2	Red/Orange

TABLE 1

6. Using the adjustable wrench, remove the hex nut and washer (Figure 10, #1) that secure the green grounding wire to the metal post on the floor of the monitor. Lift the grounding wire off the metal post.

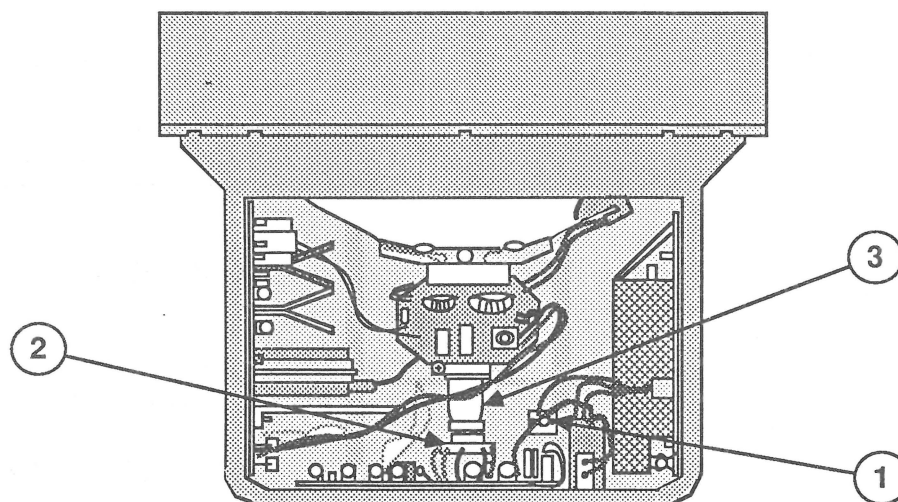


FIGURE 10

7. Pull the CRT socket (Figure 10, #2) off the neck of the CRT (Figure 10, #3).

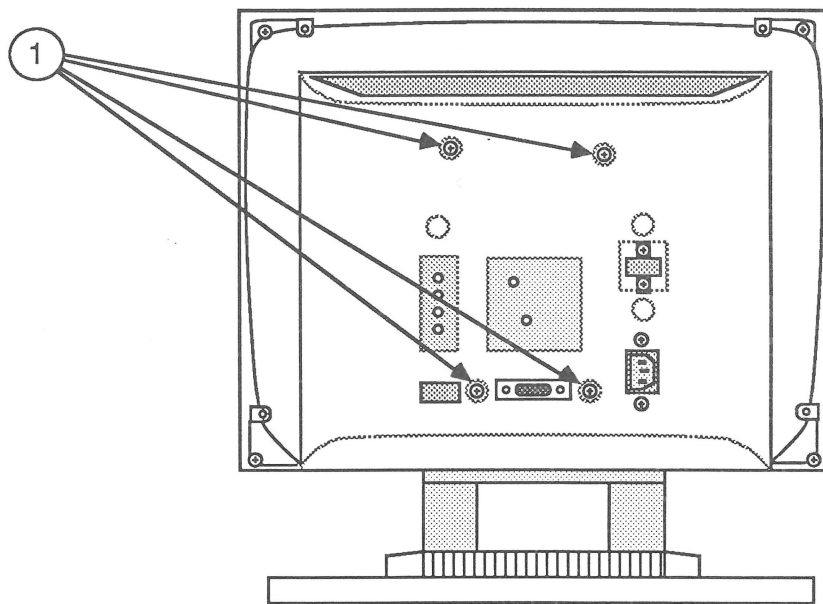


FIGURE 11

8. Remove the four screws (Figure 11, #1) that secure the video board to the chassis frame.
9. Carefully lift the video board up and out of the chassis frame.

Replace

1. Reconnect to the video board the connectors listed in Table 2 and shown in Figure 12.
2. Lower the video board into the chassis frame, folding the 6-wire cable to connector J603 (Figure 12, #4) and the 11-wire cable to connector J602 (Figure 12, #3) along the side of the video board.
3. Replace the CRT socket (Figure 12, #1) on the neck of the CRT.

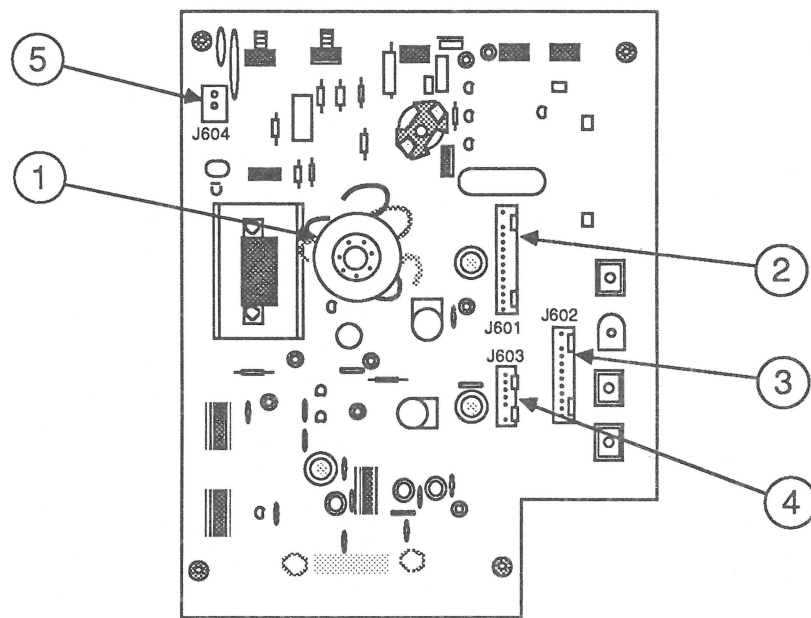


FIGURE 12

Connector	Location	No. Wires	Wire Color
J601	Figure 12, #2	13	White
J602	Figure 12, #3	11	White
J603	Figure 12, #4	6	White
J604	Figure 12, #5	2	Red/Orange

TABLE 2

...Continued on next page

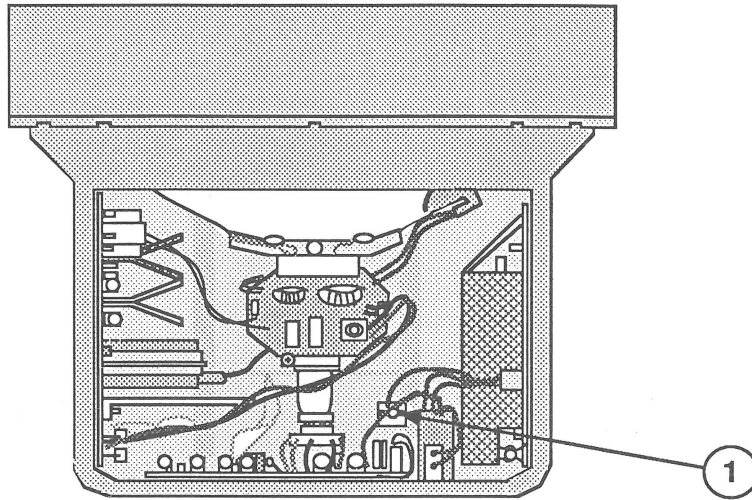


FIGURE 13

4. Lower the green grounding wire onto the metal post and replace the hex nut and washer (Figure 13, #1).
5. Replace the four screws that secure the video board to the chassis frame (Figure 14, #1).

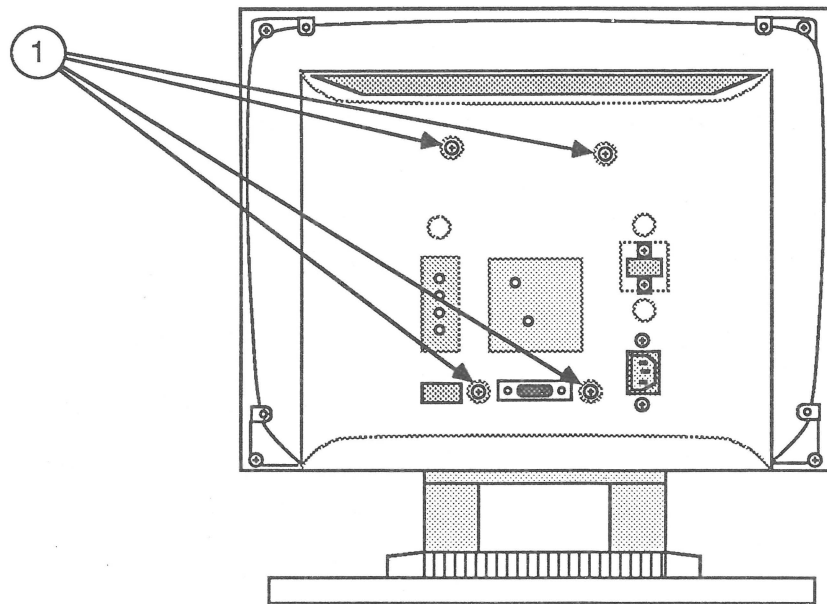


FIGURE 14

IMPORTANT: Whenever the video board is replaced, the monitor may need adjustment. Refer to Section 3, Adjustments, for information on what adjustments to perform.

6. Replace the access cover.
7. Replace the rear cover.

□ MAIN BOARD

Materials Required

#2 Phillips screwdriver
Nutdriver

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT and remove the anode cap.

WARNING: Do not put on a grounding wriststrap until ***after*** you discharge the CRT.

4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap.
5. Remove the four screws (Figure 15, #1) that secure the main board to the chassis frame.

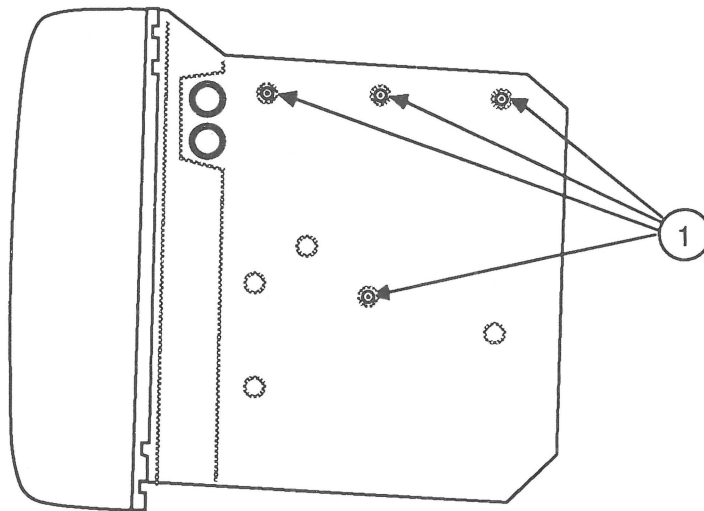


FIGURE 15

6. Disconnect from the main board the connectors listed in Table 3 and shown in Figure 16. To reach the connectors at the bottom of the logic board, you may need to pull the board halfway out of the chassis frame. **Leave the wires connected to the video board assembly.**

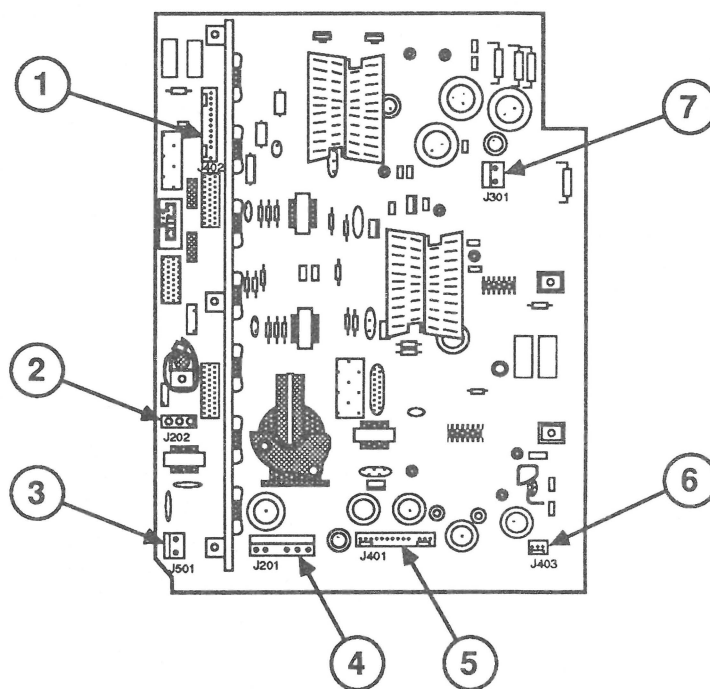


FIGURE 16

Connector	Location in Figure 16	Number of Wires	Color of Wires
J402	# 1	11	White
J202	# 2	3	Red/Blue
J501	# 3	2	Red/Orange
J201	# 4	5	Rd/Blk/Or/Yel
J401	# 5	13	White
J403	# 6	2	Grey
J301	# 7	2	Yellow/Black

TABLE 3

CAUTION: Do not remove the connectors by pulling on the connector cables. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry them apart.

7. Locate the bleeder resistor on the floor of the monitor. The resistor is either a long, round, cigar-shaped resistor (Figure 17, #1) or a tall, box-shaped resistor (Figure 17, #2).

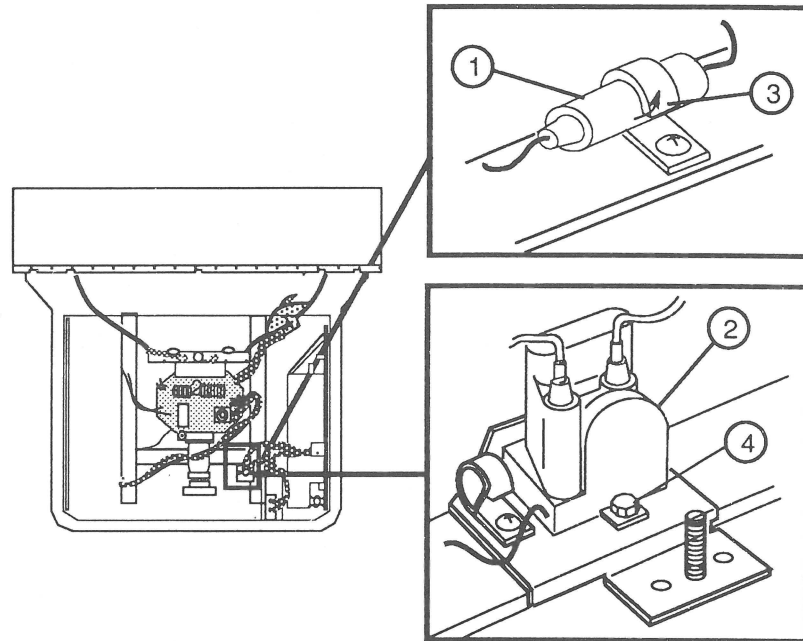


FIGURE 17

8. If the resistor is cigar shaped, slide the resistor sideways and pull up slightly on the plastic clip (Figure 17, #3) to free the resistor.

If the resistor is box shaped, use a nutdriver to remove the screw (Figure 17, #4) that holds the resistor in place. Then slide the resistor forward to release it from the metal bracket.

9. Remove the anode wire from the plastic cable clamp.
10. Lift the main board up and out of the chassis frame.

Replace

1. Starting with the connectors located at the bottom of the main board, reconnect the connectors listed in Table 4 and shown in Figure 18. **Be sure to route the three-wire cable to connector J202 over the CRT neck!**

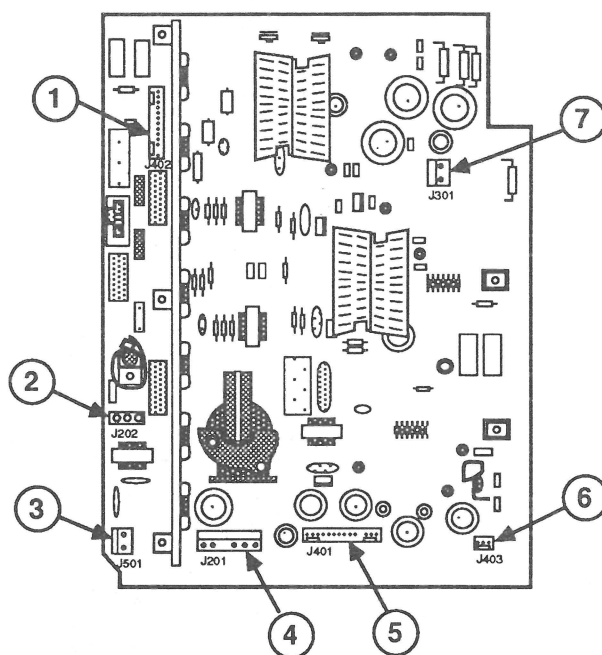


FIGURE 18

Connector	Location in Figure 18	Number of Wires	Color of Wires
J402	#1	11	White
J202	#2	3	Red/Blue
J501	#3	2	Red/Orange
J201	#4	5	Rd/Blk/Or/Yel
J401	#5	13	White
J403	#6	2	Grey
J301	#7	2	Yellow/Black

TABLE 4

2. Lower the logic board into the slot on the bottom-left side of the chassis frame. Carefully pull the anode cap and the bleeder resistor under the CRT neck.
3. If the monitor has a metal bleeder resistor bracket (Figure 19, #1) installed on the floor of the monitor, go to step 4.

3. If the monitor has a metal bleeder resistor bracket (Figure 19, #1) installed on the floor of the monitor, go to step 4.

If the monitor does not have a metal bleeder resistor bracket installed on the floor of the monitor,

- a) Remove the plastic clip (Figure 19, #2).
- b) Remove the three green wires and the nuts from the ground stud (Figure 19, #3).

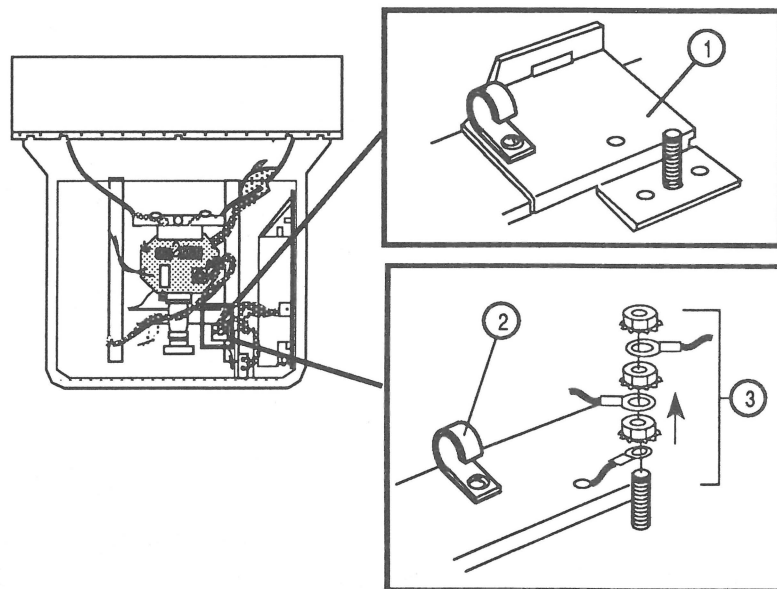


FIGURE 19

- c) Place the metal bleeder resistor bracket so that the second hole in the row of three holes fits over the ground stud (Figure 20, #1).
- d) Replace the three green (ground) wires and the nuts on the ground stud.

IMPORTANT: To assure proper grounding, secure each nut tightly before replacing the next ground wire and nut. Failure to secure each nut could cause video display problems.

- e) Replace the plastic clip (Figure 20, #2).

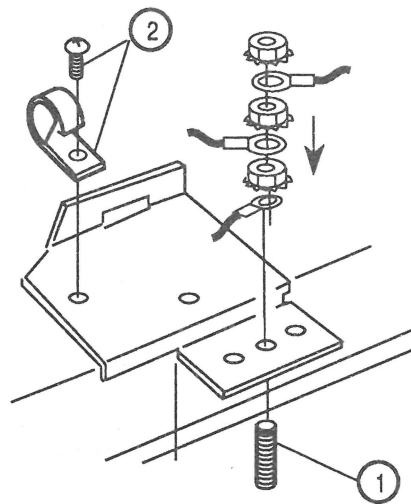


FIGURE 20

4. If the bleeder resistor is cigar shaped, install the bleeder resistor in the plastic clip on the metal bleeder resistor bracket. Pull up slightly on the clip (Figure 21, #1) and slide the resistor (Figure 21, #2) sideways until the clip is fastened securely around the middle of the resistor.

If the bleeder resistor is box shaped, place the bleeder resistor on the metal bracket so that one end slides out the rectangular hole in the rear of the metal bracket (Figure 21, #3). (Be sure that the wires going to the logic board are on your left and the anode wire is on your right.) Replace the screw that holds the bleeder resistor in place (Figure 21, #4).

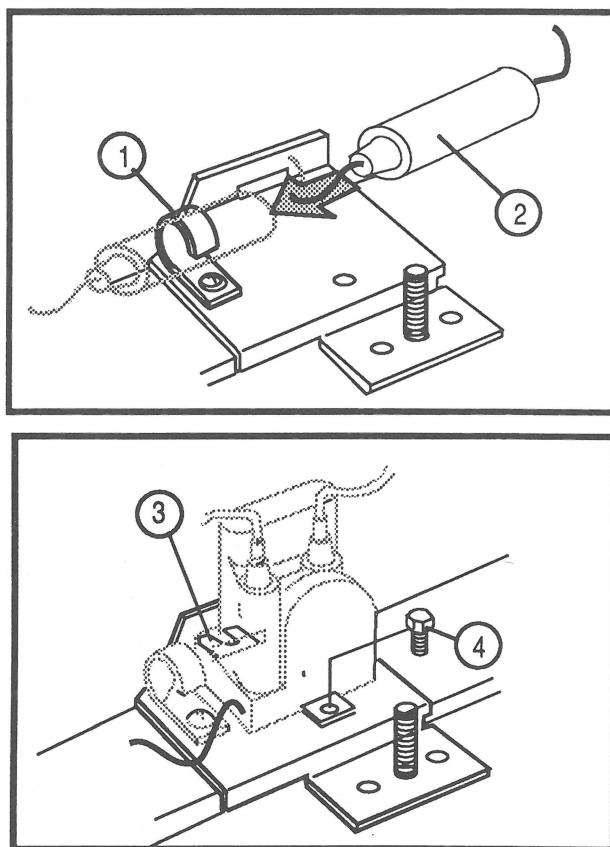


FIGURE 21

5. Place the anode wire into the plastic cable clamp.
6. Replace the four screws (Figure 22, #1) that secure the main board to the chassis frame.

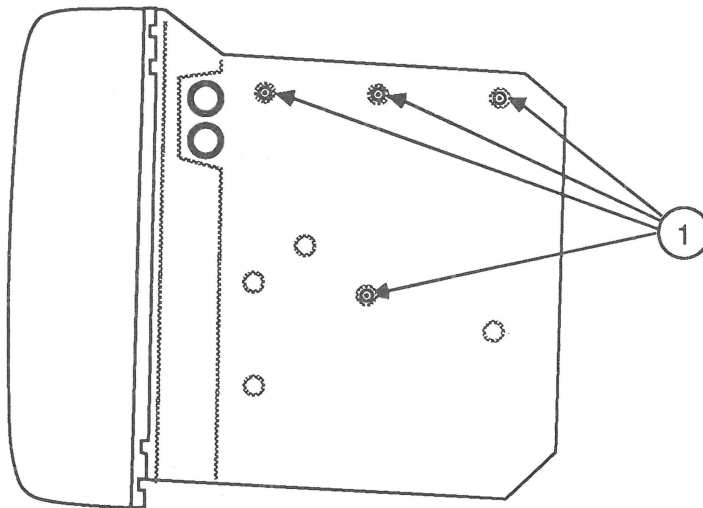


FIGURE 22

7. Replace the anode cap. (If you did not establish an ongoing ground, discharge the CRT before replacing the anode cap.)

IMPORTANT: Whenever the main board is replaced, the monitor may need adjustment. Refer to Section 3, *Adjustments*, for information on what adjustments to perform.

8. Replace the access cover.
9. Replace the rear cover.

□ POWER SUPPLY

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the wriststrap until after the CRT has been discharged.)

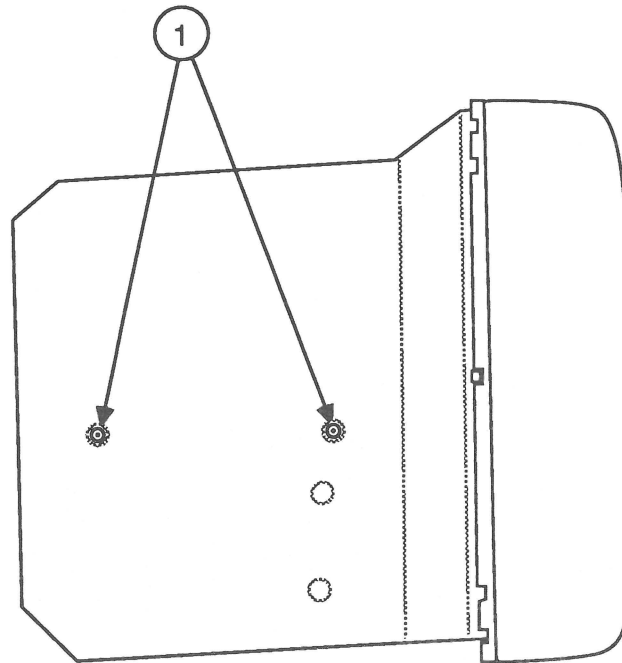


FIGURE 23

5. Remove the two screws that fasten the power supply to the chassis frame (Figure 23, #1).

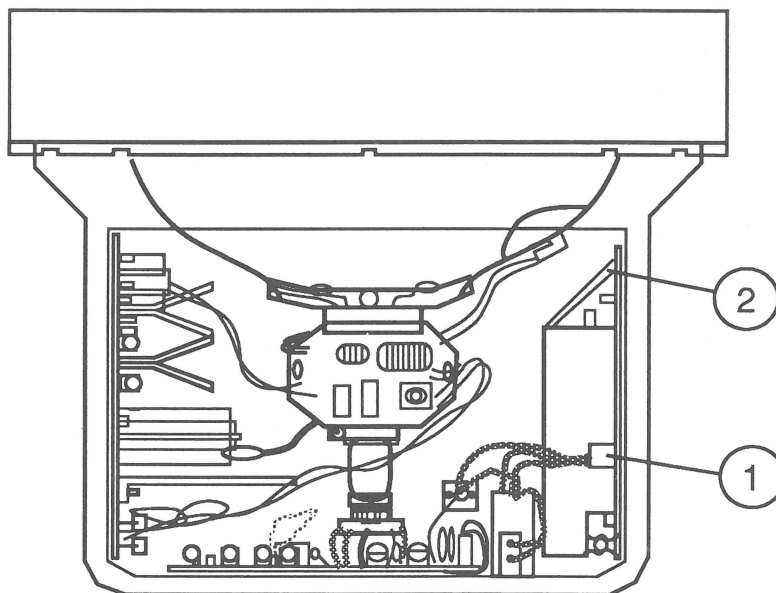


FIGURE 24

6. Disconnect the three-wire connector from the top of the power supply (Figure 24, #1) and the five-wire connector from the front side of the power supply (Figure 24, #2).
7. Carefully lift the power supply up and out of the chassis.

Replace

1. Lower the power supply into the slot on the bottom-right side of the chassis frame.
2. Reconnect the five-wire connector to the front side of the power supply (Figure 24, #2).
3. Reconnect the three-wire connector to the top of the power supply (Figure 24, #1).
4. Replace the two screws that fasten the power supply to the chassis frame (Figure 23, #1).
5. Replace the access cover.
6. Replace the rear cover.

□ FUSE

Materials Required

#2 Phillips screwdriver
Small flat-blade screwdriver

Remove

1. Remove the rear cover and the access cover.
2. Discharge the CRT.
3. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the wriststrap until after the CRT has been discharged.)
4. Locate the 2.5A 250V fuse at position F101 (Figure 25, #1) on the power supply.

Note: Some units with serial numbers between 43661GXW and 44718HQX have 1.6A indicated as the fuse amperage on the power supply PCB. This is incorrect. The correct value is 2.5A.

5. Remove the fuse by gently prying up one end of the fuse with your fingers or a flat-blade screwdriver and lifting it out.

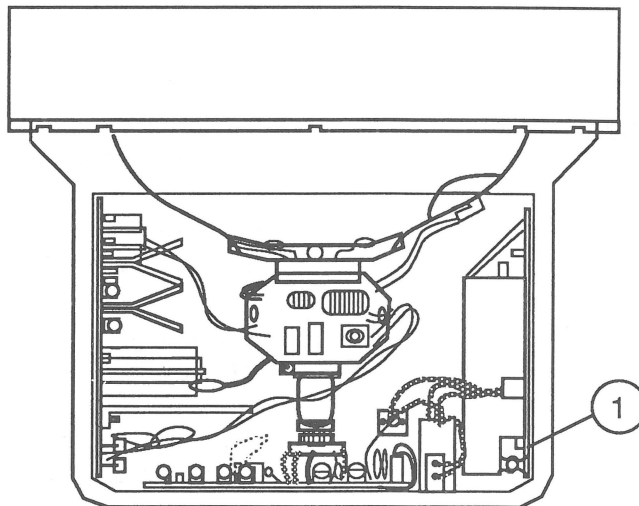


FIGURE 25

Replace

1. Carefully snap the new fuse into the fuse holder (Figure 25 #1).
2. Replace the access cover and the rear cover.

□ ON-OFF SWITCH FILTER ASSEMBLY

Materials Required

- #1 Phillips screwdriver
- #2 Phillips screwdriver

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on a grounding wriststrap until after the CRT has been discharged.)
5. Disconnect the large three-wire connector from the top of the power supply (Figure 26, #1).

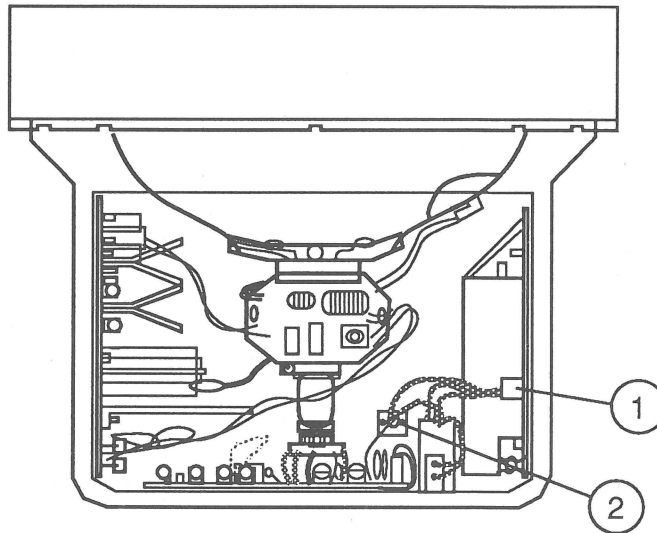


FIGURE 26

6. Remove the three hex nuts and washers (Figure 26, #2) that secure the three grounding wires to the metal post on the floor of the monitor.
7. Lift the three grounding wires off the post.

8. Pull the plastic knob off the on/off switch shank (Figure 27, #1).
9. Remove the two outside screws that secure the on/off switch to the chassis frame (Figure 27, #2).
10. Remove the two outside screws (Figure 27, #3) that connect the A/C power socket to the chassis frame. Lift out the on/off switch assembly.

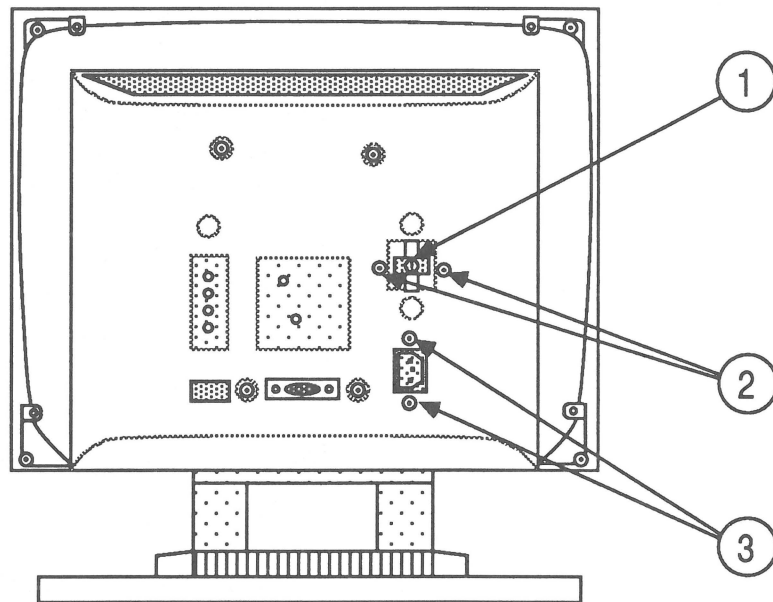


FIGURE 27

Replace

1. Install the on/off switch assembly inside the chassis frame, aligning the A/C power socket with the bottom opening on the back of the chassis frame.
2. Replace the two screws that secure the A/C power socket to the chassis frame (Figure 27, #3).
3. Push the on/off switch stem through the top opening, and replace the two screws that secure the switch to the chassis frame (Figure 27, #2).
4. Install the plastic knob on the switch shank (Figure 27, #1).
5. Connect the three-wire connector to the top of the power supply (Figure 28, #1).

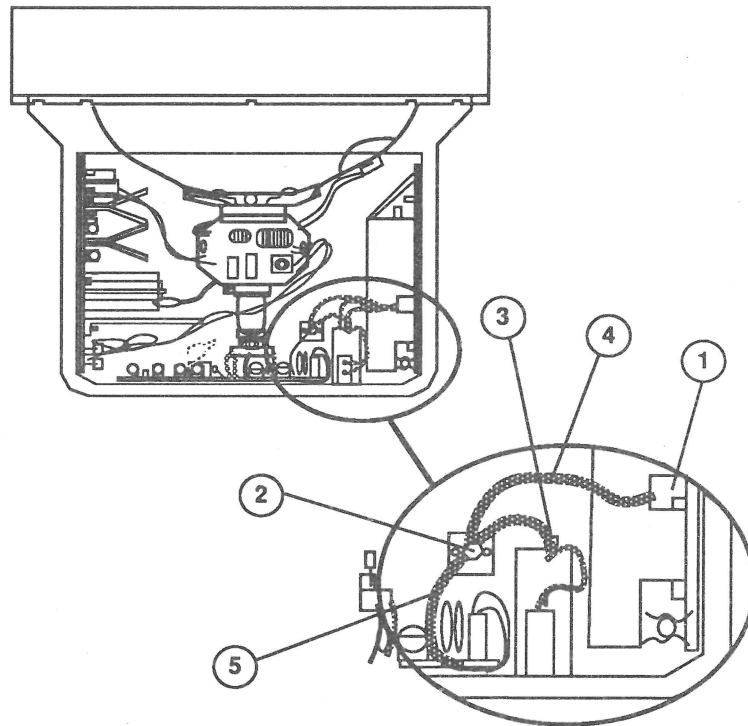


FIGURE 28

6. Replace the three grounding wires:
 - a) Lower the wire (Figure 28, #3) attached to the on-off switch onto the metal post (Figure 28, #2), and replace the hex nut and washer.
 - b) Lower the wire (Figure 28, #4) attached to the three-wire connector onto the metal post (Figure 28, #2), and replace the hex nut and washer.
 - c) Lower the wire (Figure 28, #5) attached to the video board onto the metal post (Figure 28, #2), and replace the hex nut and washer.
7. Replace the access cover.
8. Replace the rear cover.

❑ CONTRAST-BRIGHTNESS ASSEMBLY

Materials Required

#2 Phillips screwdriver
Adjustable wrench

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after the CRT has been discharged.)

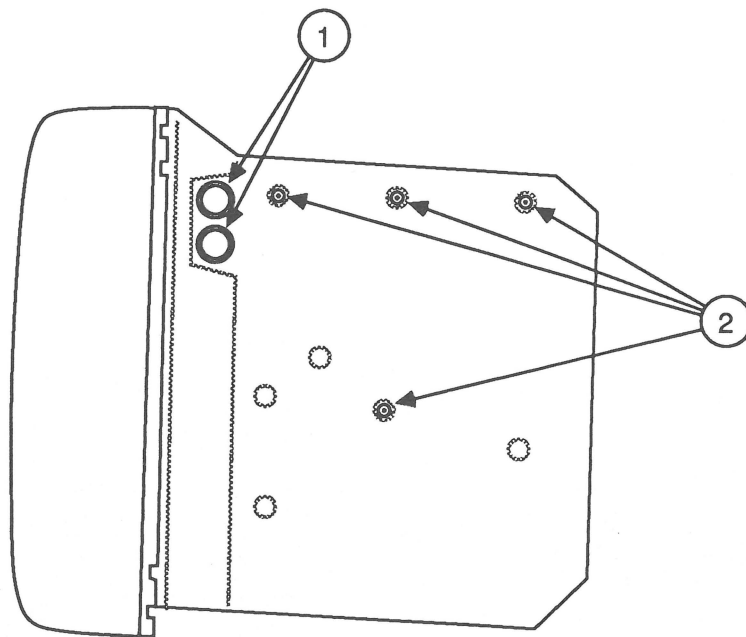


FIGURE 29

5. Pull off the contrast and brightness control knobs (Figure 29, #1).
6. Remove the four screws (Figure 29, #2) that secure the main board to the chassis. Pull the logic board slightly away from the side of the chassis.
7. Disconnect the six-wire cable from connector J603 (Figure 30, #1) on the video board.

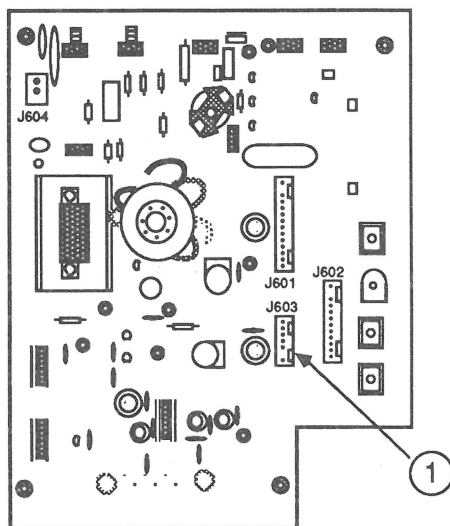


FIGURE 30

8. Using the adjustable wrench, remove the two hex nuts (Figure 31, #1) that secure the contrast-brightness assembly to the chassis frame.

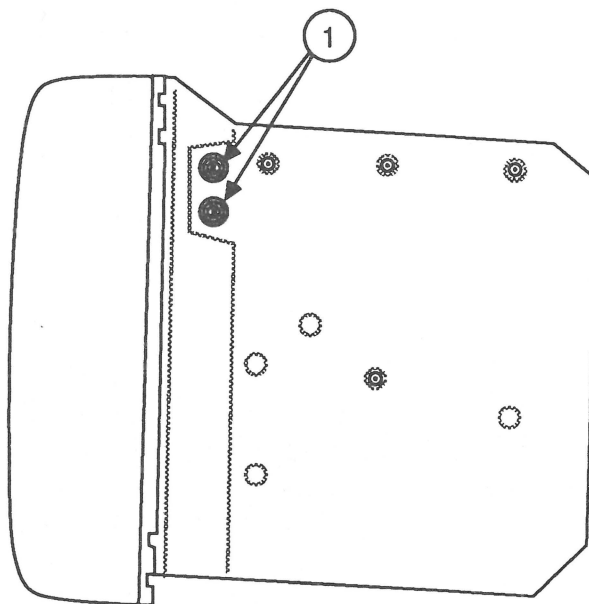


FIGURE 31

9. Push the knob shanks through the side openings and lift the contrast-brightness assembly out of the chassis frame.

Replace

1. Install the knob shanks from inside to outside through the side openings on the chassis frame. Install the shank with the **red** wire through the bottom opening.
2. Replace the two hex nuts (Figure 32, #1) that secure the contrast-brightness assembly to the outside of the chassis frame.

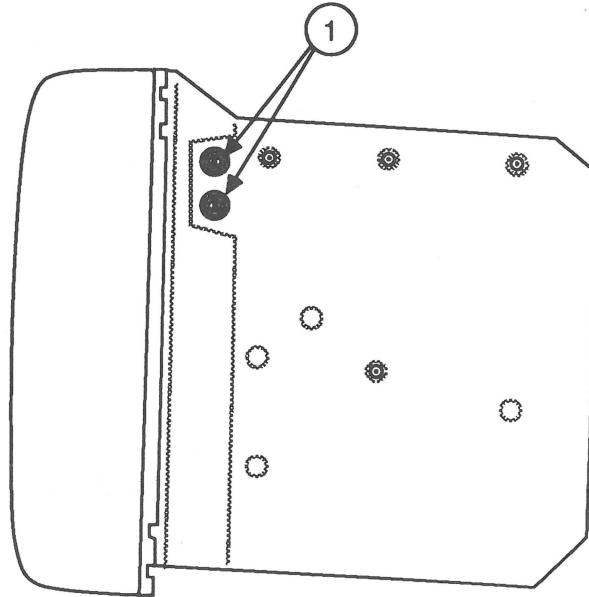


FIGURE 32

3. Reconnect the six-wire cable to connector J603 (Figure 33, #1) on the video board, threading the cable along the top of the main board. Fold the excess cable alongside the video board.
4. Replace the four screws (Figure 34, #2) that secure the main board to the chassis frame.
5. Replace the control knobs (Figure 34, #1).

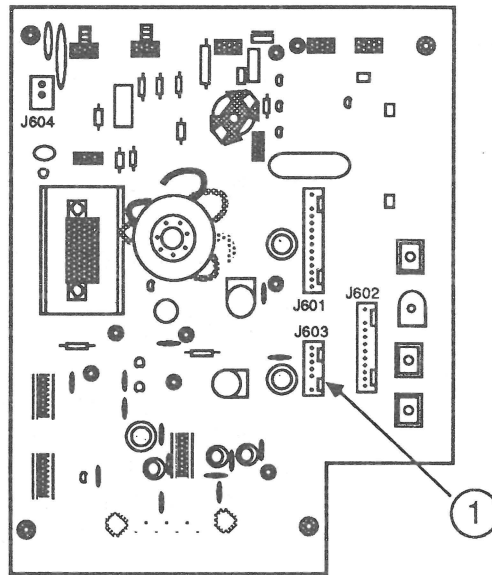


FIGURE 33

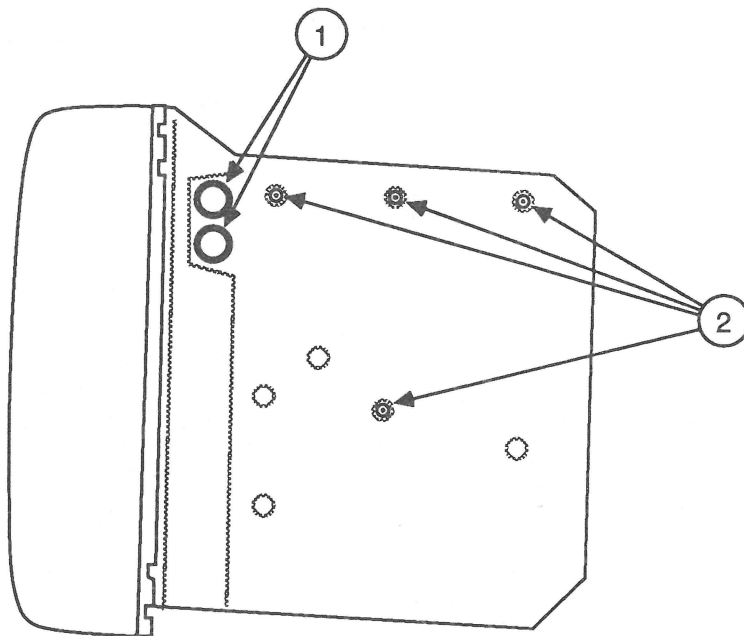


FIGURE 34

6. Replace the access cover.
7. Replace the rear cover.

□ BEZEL

Materials Required

#2 Phillips screwdriver
1/4-inch nutdriver

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after the CRT has been discharged.)

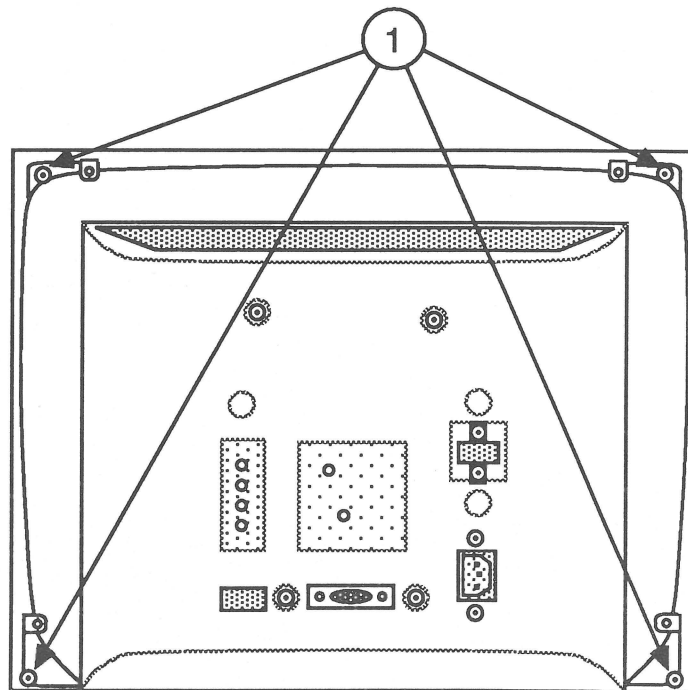


FIGURE 35

5. Remove the four corner hex nuts (Figure 35, #1) that secure the bezel to the chassis frame.
6. Lift the bezel off the chassis frame.

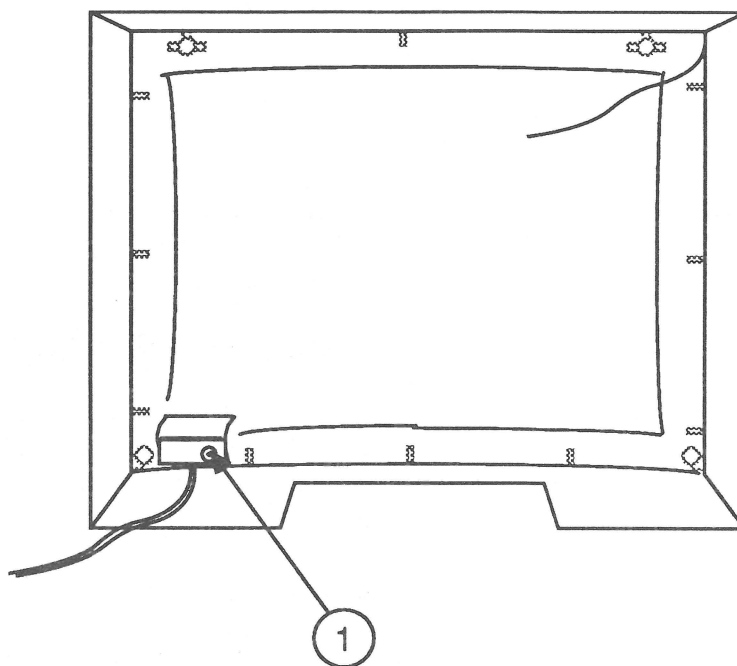


FIGURE 36

7. Remove the hex nut (Figure 36, #1) that secures the LED assembly and the black paper baffle to the front bezel.

Replace

1. Install the LED assembly in its place in the front bezel. Be sure to line up the holes on the LED board with the guide tabs provided on the bezel.
2. Cover the LED assembly with the black paper baffle and replace the hex nut (Figure 36, #1) that secures both the LED and the baffle to the front bezel.
3. Lift the bezel onto the chassis frame, taking care not to pinch the LED cable between the bezel and the monitor screen.
4. Replace the four corner hex nuts (Figure 35, #1) that secure the chassis frame to the front bezel.
5. Replace the access cover.
6. Replace the rear cover.

❑ CATHODE-RAY TUBE (CRT)

Materials Required

#2 Phillips screwdriver
Safety goggles

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT and remove the anode cap.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after the CRT has been discharged.)
5. Remove the bezel.
6. Remove the monitor tilt-swivel stand.

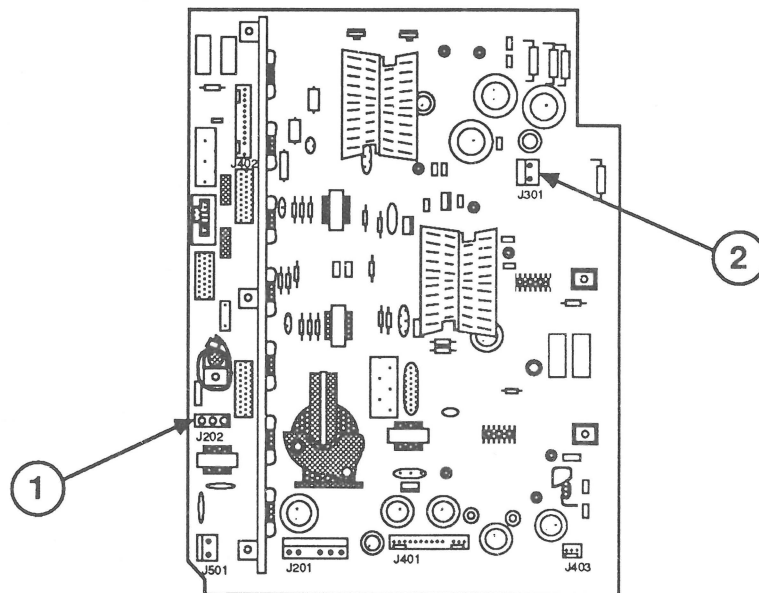


FIGURE 37

7. Disconnect from the main board the two connectors listed in Table 5 and shown in Figure 37.

Connector	Location	No. Wires	To or From
J202	Figure 35, #1	3	CRT neck
J301	Figure 35, #2	2	CRT neck

TABLE 5

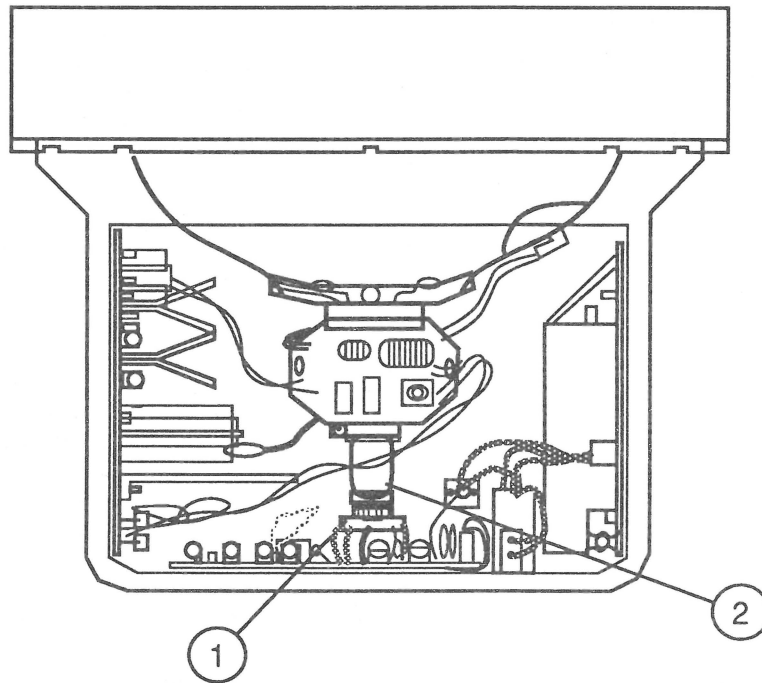


FIGURE 38

8. Pull the CRT socket (Figure 38, #1) off the neck of the CRT (Figure 36, #2).

9. While supporting the CRT with one hand, remove the four screws and washers that secure the CRT to the chassis frame (Figure 39, #1). **If the washers fall off, pick them up and save them. You will need them when replacing the CRT.**

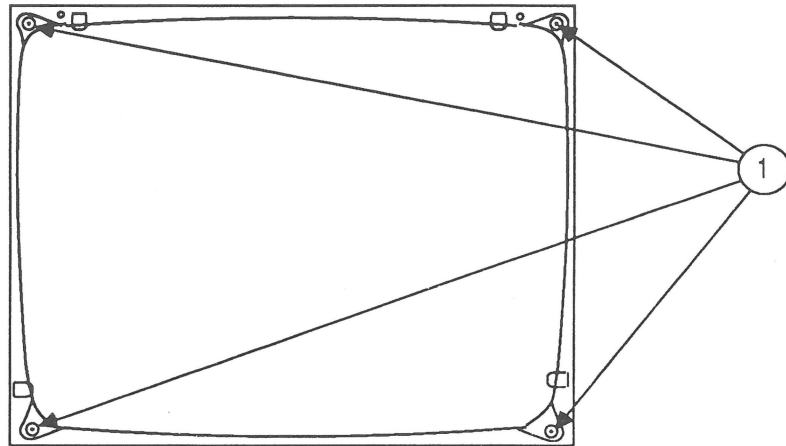


FIGURE 39

10. Carefully grasp the sides of the CRT and ease the CRT out of the chassis frame. **Do not handle the CRT by the neck!**
11. Gently place the CRT face down on a soft, protective surface.
12. Remove the grounding strap (Figure 40, #1) and the spring (Figure 40, #2). Save them to use on your replacement CRT.

WARNING: If you need to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" under the You Oughta Know tab.

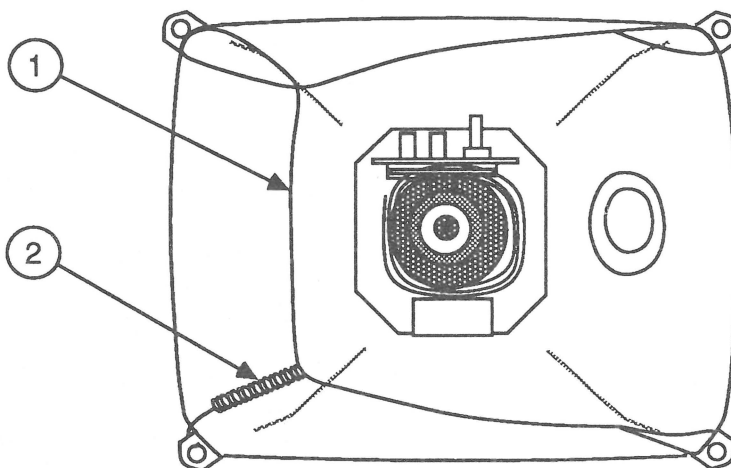


FIGURE 40

Replace

1. Replace the grounding strap (Figure 40, #1) and the spring (Figure 40, #2).
2. Gently ease the CRT into the chassis frame, making sure that the anode aperture is positioned directly in front of the power supply.
3. Replace the four screws and washers that secure the CRT to the chassis frame (Figure 39, #1).

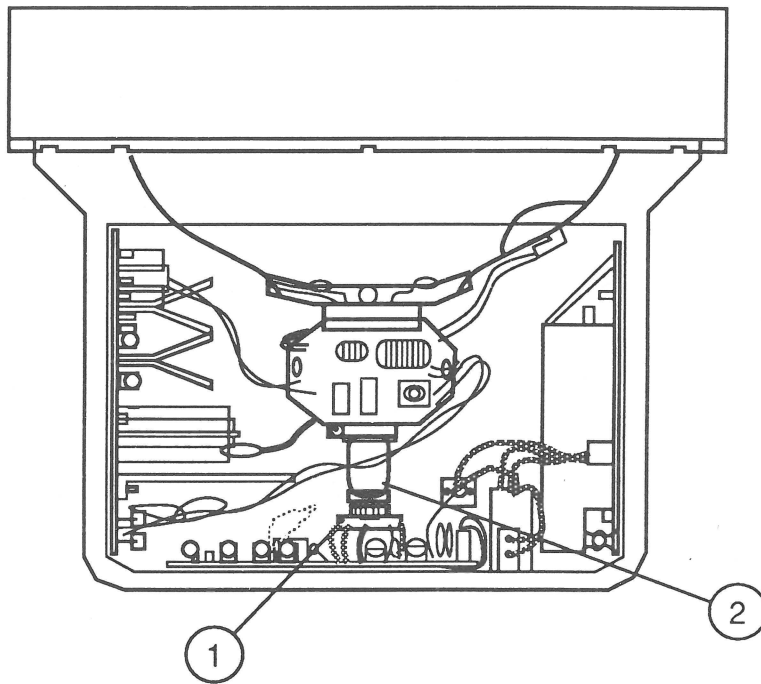


FIGURE 41

4. Replace the CRT socket (Figure 41, #1) on the neck of the CRT (Figure 41, #2).
5. Reconnect to the main board the two connectors listed in Table 6 and Figure 42.

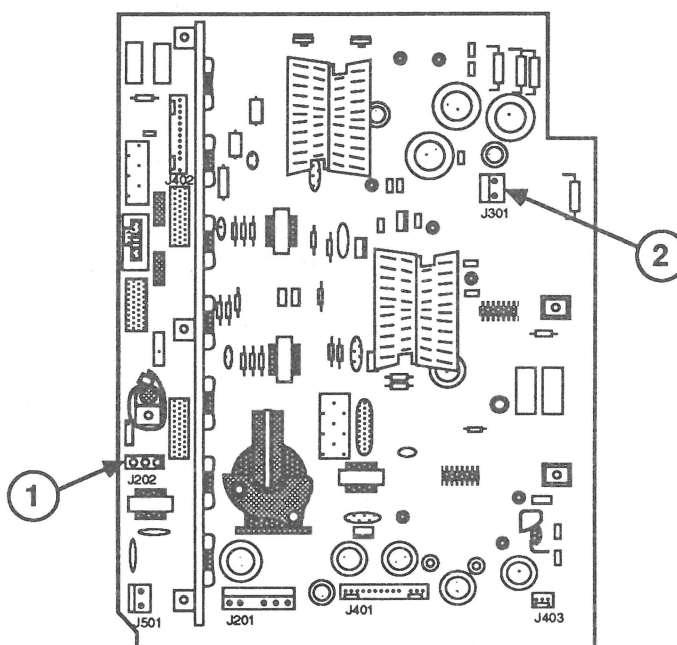


FIGURE 42

Connector	Location	No. Wires	To or From
J202	Figure 40, #1	3	CRT neck
J301	Figure 40, #2	2	CRT neck

TABLE 6

6. Replace the monitor stand.
7. Replace the bezel.
8. Replace the anode cap.

IMPORTANT: Whenever the CRT is replaced, the monitor may need adjustment. Refer to Section 3, Adjustments, for information on what adjustments to perform.

9. Replace the access cover.
10. Replace the rear cover.

❑ LED ASSEMBLY

Materials Required

#2 Phillips screwdriver
Flat-blade screwdriver

Remove

1. Remove the rear cover.
2. Remove the access cover.
3. Discharge the CRT and remove the anode cap.
4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after the CRT has been discharged.)
5. Remove the bezel.
6. Remove the monitor stand.
7. Remove the CRT.

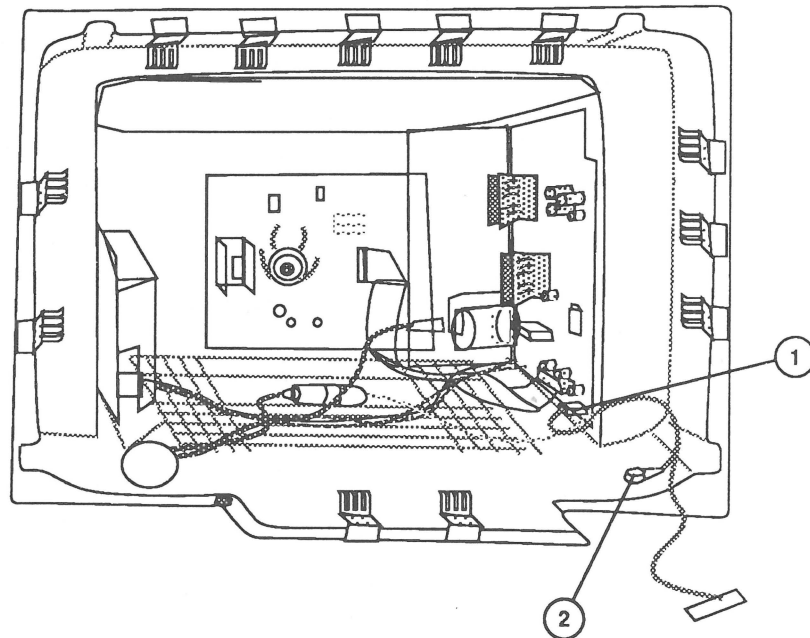


FIGURE 43

8. Disconnect the LED cable (Figure 43, #1) from the main board.

9. Remove the hex nut that secures the green grounding wire (Figure 43, #2) to the inside of the chassis frame. Lift out the LED board and cable assembly.

Replace

1. Reconnect the LED cable (Figure 43, #1) to the main board.
2. Replace the hex nut that secures the green grounding wire (Figure 43, #2) to the chassis frame.
3. Replace the CRT.
4. Replace the monitor stand.
5. Replace the bezel.
6. Replace the anode cap. (If you did not establish an ongoing ground, discharge the CRT before replacing the anode cap.)
7. Replace the access cover.
8. Replace the rear cover.

Apple Two-Page Monochrome Monitor

Section 3 – Adjustments

□ CONTENTS

3.2	Introduction
3.2	Do Not Adjust the Yoke
3.2	Safety Instructions
3.3	Live Adjustment Rules
3.4	Location of Controls
3.4	User Controls
3.4	External Service Controls
3.5	Internal Service Controls
3.6	MacTest II/IIx Test Patterns
3.6	Materials Required
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3.9	Adjustment Procedures
3.9	Materials Required
3.9	Horizontal Adjustment
3.14	Vertical Adjustments
3.16	Cutoff
3.17	Screen Luminance
3.20	Focus
3.21	MacTest IIcx/IIci Test Patterns
3.21	Materials Required
3.21	Generating the Test Patterns

□ INTRODUCTION

Whenever you replace the CRT, the main board, or the video board on the Apple Two-Page Monochrome Monitor, some adjustment of the monitor's video display may be necessary. Use the following procedures to perform horizontal, vertical, cutoff, screen luminance, and focus adjustments.

Do Not Adjust the Yoke

All yoke adjustments have been set by the manufacturer. Do not attempt any tilt, ring, or geometric adjustments on the Apple Two-Page Monochrome Monitor.

If the following procedures do not correct the monitor's adjustment problems, isolate the faulty module (see Section 4, Troubleshooting) and return the module to Apple.

□ SAFETY INSTRUCTIONS

WARNING: The Apple Two-Page Monochrome Monitor contains a high-vacuum picture tube and operates at very high voltages. To prevent serious injury, learn all safety precautions outlined in Section 1, Basics, before you proceed.

In addition to following all safety precautions in the Basics section:

- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with your other hand.
- Use a mirror for viewing adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to the back of the monitor to rotate the controls—you cannot see what you are about to touch!
- Perform only those adjustments that are absolutely necessary. **Do not attempt to make any adjustments other than the ones explained in this section, and do these with extreme caution.**

Live Adjustment Rules

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Apple Two-Page Monochrome Monitor:

- Any part of the yoke assembly including the yoke wires (Figure 1, #1)
- The anode wire (Figure 1, #2)
- The anode connector (Figure 1, #3)
- The flyback transformer (Figure 1, #4)
- The inside of the AC power switch (Figure 1, #5)
- The primary fuse (Figure 1, #6)

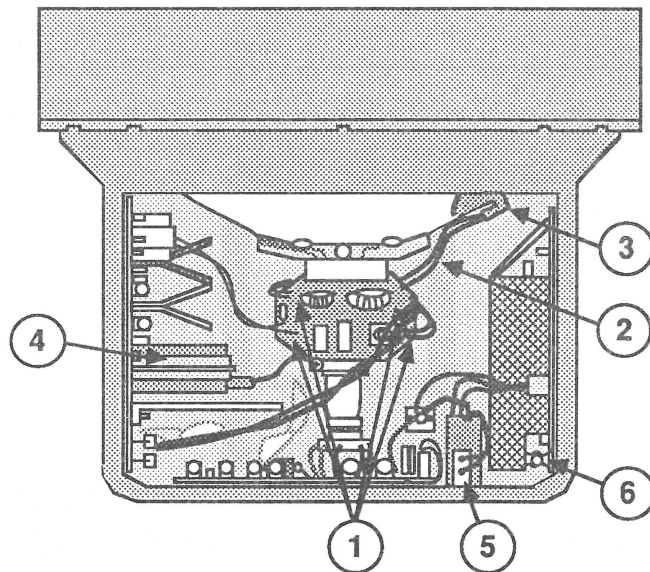


FIGURE 1

WARNING: Serious injury could result if you touch any of these components with the power on.

□ LOCATION OF CONTROLS

User Controls

The BRIGHTNESS control (Figure 2, #1) and the CONTRAST control (Figure 2, #2) are located on the side of the monitor and can be adjusted by the user.

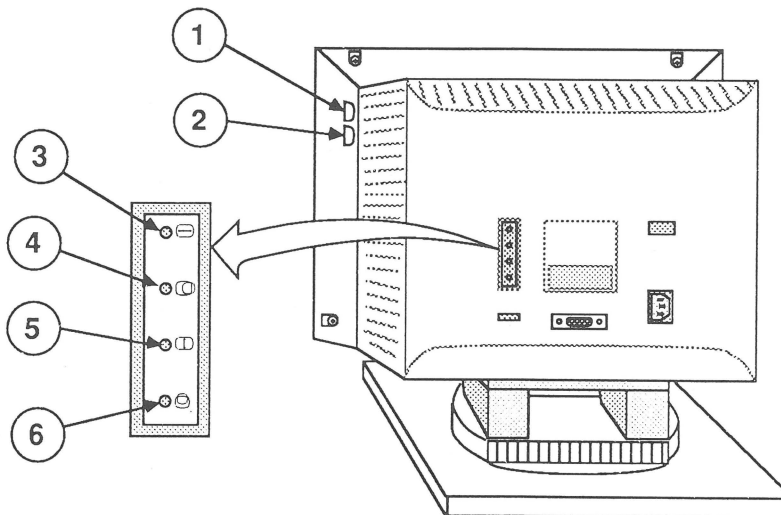


FIGURE 2

External Service Controls

The following service adjustment controls are located on the video board, but can be accessed by removing a plastic panel found on the rear cover:

- HORIZONTAL SIZE (Figure 2, #3)
- HORIZONTAL SHIFT (Figure 2, #4)
- VERTICAL SIZE (Figure 2, #5)
- VERTICAL SHIFT (Figure 2, #6)

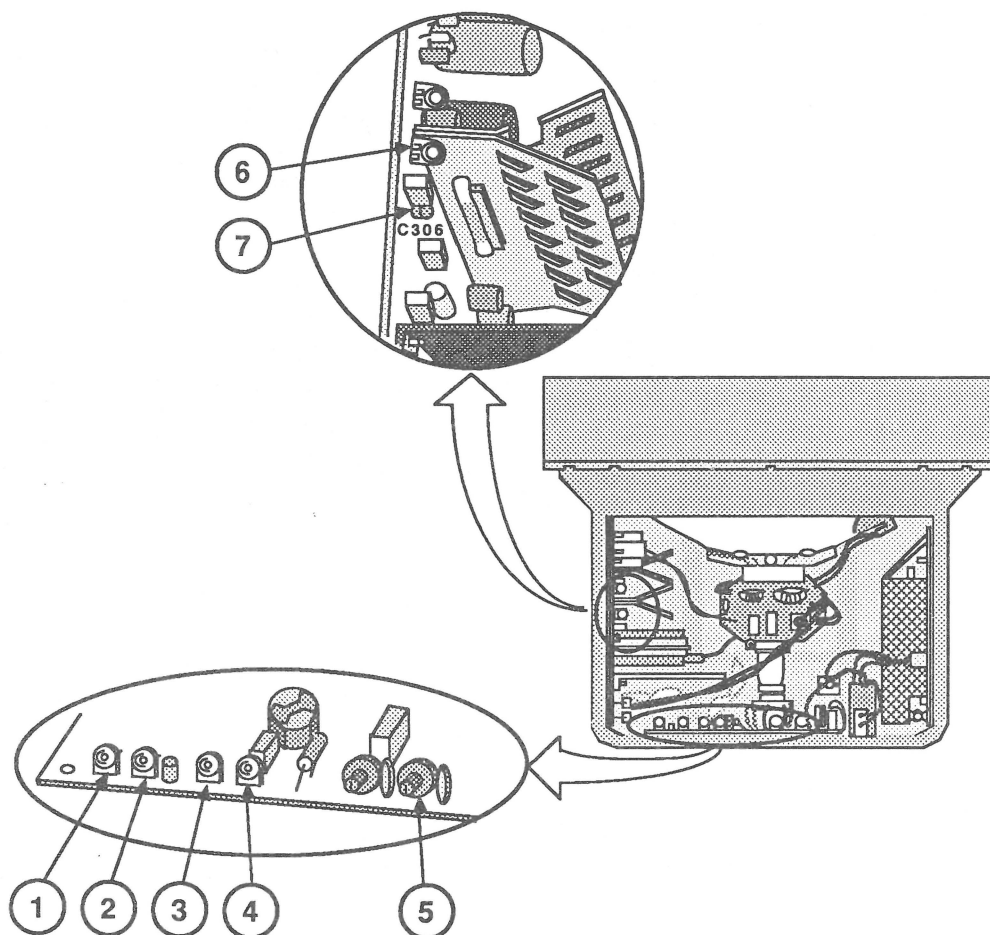


FIGURE 3

Internal Service Controls

Other service adjustment controls are located on the video board and the main board. These controls can be accessed only after removing the rear cover.

Video board:

- CUTOFF (Figure 3, #1)
- BRIGHTNESS RANGE (Figure 3, #2)
- VERTICAL FOCUS (Figure 3, #3)
- HORIZONTAL FOCUS (Figure 3, #4)
- STATIC FOCUS (Figure 3, #5)

Main board:

- VERTICAL LINEARITY (Figure 3, #6)
- VERTICAL LINEARITY (TOP) (Figure 3, #7)

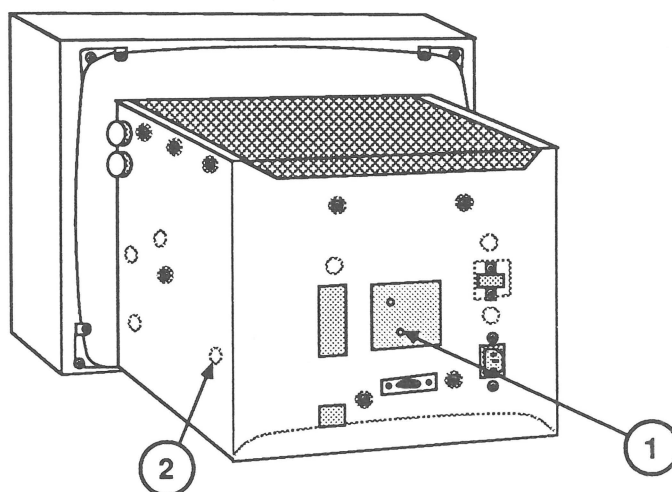


FIGURE 4

Video board:

- SUBCONTRAST (Figure 4, #1)

Main board:

- HORIZONTAL LINEARITY (Figure 4, #2)

□ MACTEST II/IIX TEST PATTERNS

Use the following procedure to display test patterns on a Two-Page Monochrome Monitor that is connected to a Macintosh II or Macintosh IIX computer. Refer to "MacTest IICX/IICI Test Patterns" in this section to display test patterns using a Macintosh IICX or Macintosh IICI and the *MacTest IICX/IICI* diagnostic.


Materials Required

Macintosh II or Macintosh IIX
Two-Page Monochrome Video Card
MacTest™ II/IIX disk (version 3.1 or higher)

IMPORTANT: The Two-Page Monochrome Video Card RAM must be upgraded to 512K in order to display the *MacTest II/IIX* test patterns.

Generating the Test Patterns

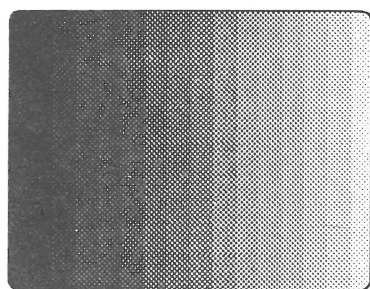
MacTest II/Ix tests the video RAM on the Two-Page Monochrome Video Card and displays test patterns used to adjust the monitor. Follow the steps below.

1. Connect the monitor's video cable and power cord to the Macintosh II or Macintosh Ix computer.
 2. Boot the *MacTest II/Ix* disk from Drive 1 (the drive on the right).
 3. As the program boots, *MacTest II/Ix* displays a window instructing you to turn off the system and connect a SCSI loopback card. Unless you wish to test the logic board, click **OK** to get to the Start window.
 4. When the Start window appears, select the  menu, open the Control Panel, and click the Monitors icon.
 5. In the area called **Characteristics of Selected Monitor**, select **Black & White/Grays**; in the box called **Grays**, select **16**.
 6. The *MacTest II/Ix* test patterns will appear only on the main monitor. If you have more than one monitor connected to the Macintosh II or Ix, the box at the bottom of the panel will show an icon for each monitor. The monitor icon with the menu bar is the main monitor. Drag the menu bar to the icon that represents the monitor on which you want to display the test patterns.
 7. Close the Control Panel to return to the Start window.
- Note:** If you selected a new main monitor, you must quit and restart *MacTest II/Ix* in order for this change to take effect.
8. Select **Test Selections** from the Options menu. Deselect the default Logic and Disk Drive tests by clicking once in their selection boxes to remove the Xs.
 9. If you want to test the video card, click **Video Card in slot**.
 10. Click **Video monitor** to display the video adjustment test patterns.

11. Click **OK** to close the test selection window.
12. When the Start window appears, click **Start** to display the test patterns.

Note: If you selected the video card test, the following message will be displayed: **Testing Mac II Video Card**. You will see horizontal and vertical lines flash across the screen. After about one minute, the Start window will reappear, followed by the first test pattern display.

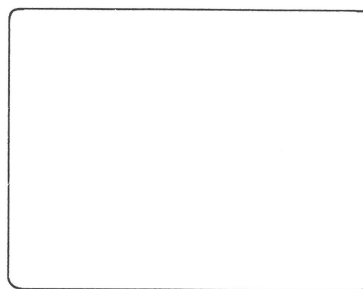
13. The Video monitor test displays the following test patterns:



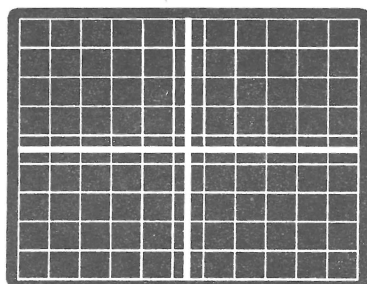
Gray Bars



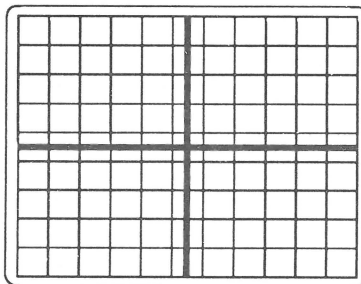
Full Black Screen



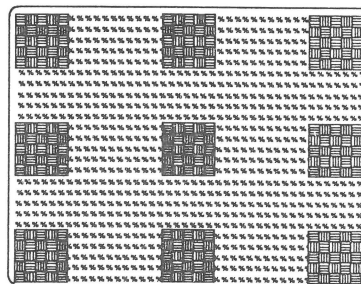
Full White Screen



Cross Hatch I
(Black Background)



Cross Hatch II
(White Background)



Focus

FIGURE 5

To advance to the test pattern you want, click the mouse or strike any key on the keyboard. Each test pattern is displayed once. When you have advanced through each pattern, you will return to the Waiting for Start window. To redisplay the test patterns, click **Start**.

□ ADJUSTMENT PROCEDURES

Materials Required

Plastic alignment tool (metal tip)
Linearity adjustment tool
Light meter (Sekonic Multi-Lumi, model L-248)
Flexible ruler
Mirror

Horizontal Adjustment

Perform the horizontal adjustment procedure whenever the CRT or the main board is replaced.

1. Display **Crosshatch II** test pattern on the monitor screen (see "Test Patterns").

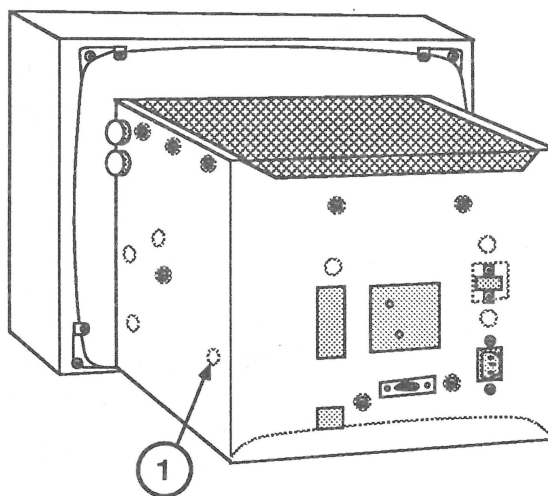


FIGURE 6

2. Using the linearity adjustment tool, adjust the HORIZONTAL LINEARITY control (Figure 6, #1) clockwise or counterclockwise until the raster (illuminated part of the screen) is as wide as possible.

CAUTION: *The linearity adjustment tool is the only tool that can be used to adjust the HORIZONTAL LINEARITY control! Use of any other adjustment tool may damage the adjustment control coil core or cause a short in the monitor's circuitry.*

3. Then, slowly adjust the HORIZONTAL LINEARITY control (Figure 7, #1) clockwise or counterclockwise until both the left and right halves of the raster are the same distance from the center of the screen (Figure 8, #1).

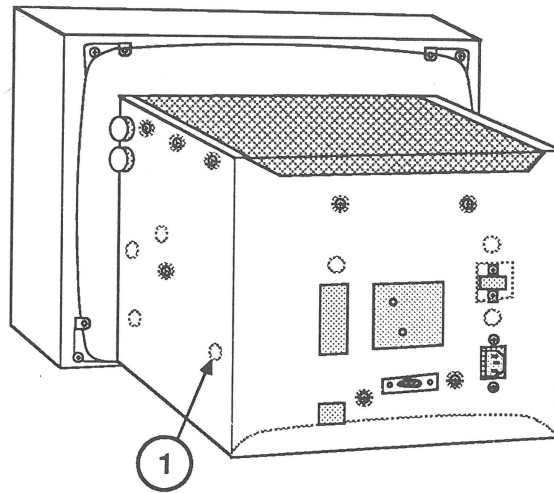


FIGURE 7

Note: To measure the left half of the raster, place a flexible ruler against the screen directly over the black horizontal line. Align the zero mark of the ruler with the left edge of the raster. While holding the ruler in this position, note the ruler measurement at the point where the two black lines intersect (Figure 8, #1). To measure the right half of the raster, align the zero mark of the ruler at the point where the two black lines intersect (Figure 8, #1). While holding the ruler in this position, note the ruler measurement at the right edge of the raster.

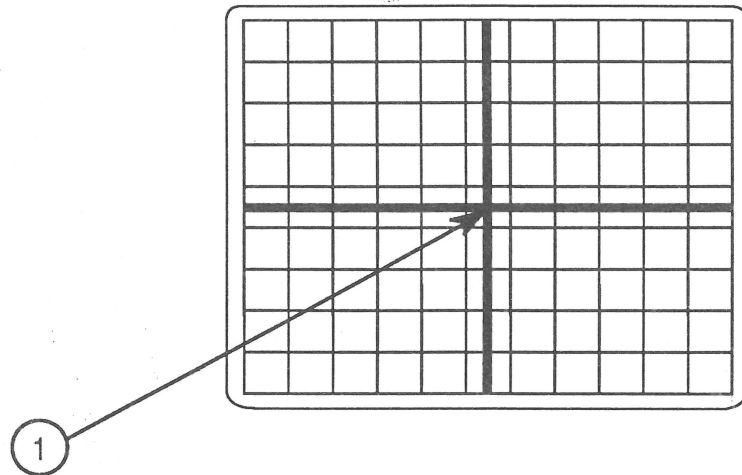


FIGURE 8

4. Now, measure the total width of the raster by placing a flexible ruler against the screen and aligning the zero at the left edge of the raster. Note the ruler measurement at the right edge of the raster. If necessary, use the plastic alignment tool to adjust the HORIZONTAL SIZE control (Figure 9, #1) until the total width of the raster is 15 inches.

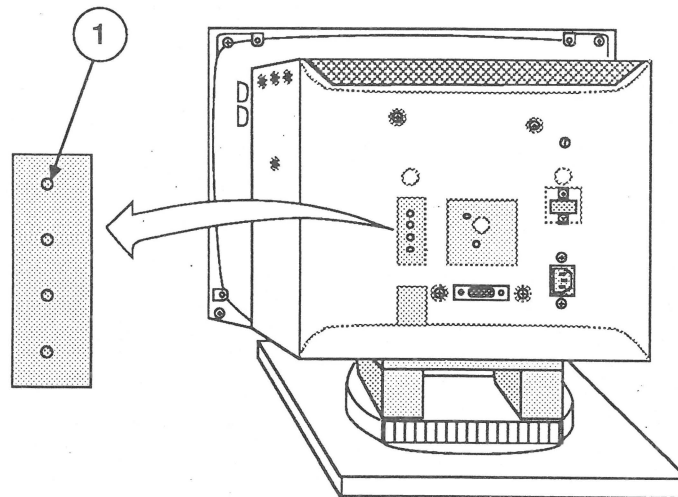


FIGURE 9

5. Verify that the left and right halves of the raster are still the same distance from the box at the center of the screen. If necessary, readjust the HORIZONTAL LINEARITY control (Figure 7, #1) until the left and right sides of the screen are the same size.

6. Verify that the boxes on both the left and right sides of the monitor screen are the same size as the boxes located in the center of the screen. If they are not, perform the following steps:

WARNING: *The Apple Two-Page Monochrome Monitor operates at extremely high voltages. To prevent electrical shock, use an insulated (nonmetal) tool to set the 3-position switch (Figure 10, #1) on the main board.*

- a) Using an insulated (**nonmetal**) tool, carefully reach inside the monitor chassis and set the 3-position switch (Figure 10, #1) located on the main board to the lowest of the three switch settings. **Avoid touching the heatsink or any other part of the monitor.**

WARNING: *If you do not use an insulated (nonmetal) tool to set the 3-position switch (Figure 10, #1), you must turn the power off before reaching inside the chassis to adjust the switch, and then turn the power back on to view the monitor screen.*

- b) Check the crosshatch display on the monitor screen.
- c) If the boxes at the left and right sides of the monitor screen are **not** the same size as the boxes in the center of the screen, set the 3-position switch to the next higher setting and check the crosshatch display.
- d) If the boxes are still not equal in size, set the 3-position switch to the third setting and check the crosshatch display. After trying all settings, select the best one.

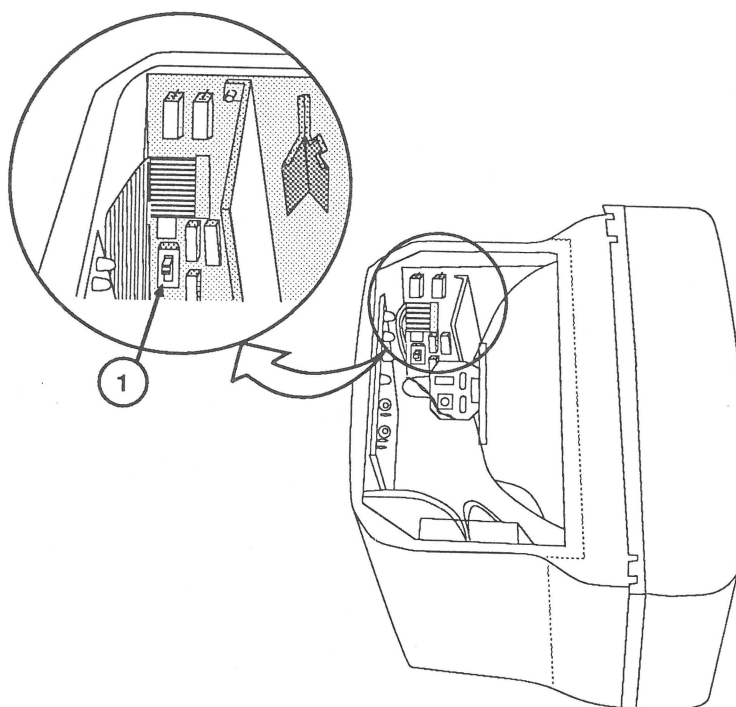


FIGURE 10

7. Check that the total width of the raster is still 15 inches. If it is not, use the plastic alignment tool to adjust the HORIZONTAL SIZE control (Figure 11, #1) until the raster is 15 inches wide.

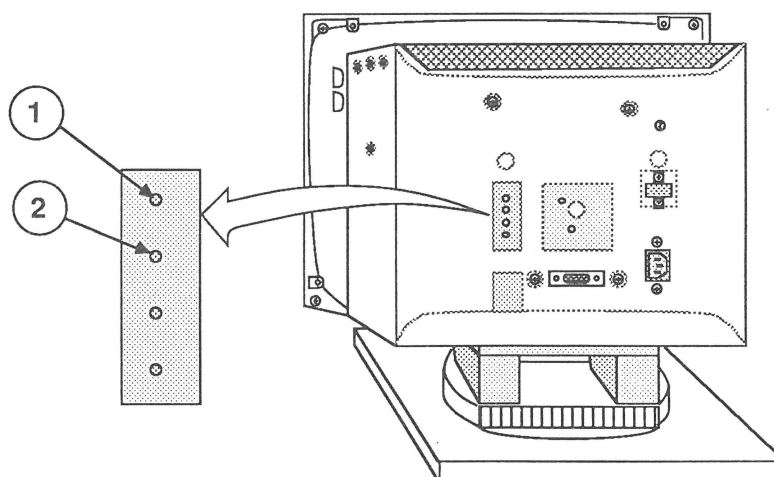


FIGURE 11

8. If necessary, use the plastic alignment tool to adjust the HORIZONTAL SHIFT control (Figure 11, #2) until the raster is centered on the screen.

Vertical Adjustments

Perform the following vertical adjustment procedures whenever the main board is replaced.

WARNING: *There are extremely high voltages on the entire yoke assembly (Figure 12, #1). To prevent electrical shock, do not touch the yoke assembly or any of the yoke wires when performing vertical adjustments!*

Vertical Linearity

1. Display either the **Crosshatch I** or **Crosshatch II** test pattern on the monitor screen (see "Test Patterns").
2. If the top two rows of boxes on the screen are not the same height, use a plastic alignment tool to adjust the orange capacitor at C306 (Figure 12, #2) on the main board until the boxes are the same height.

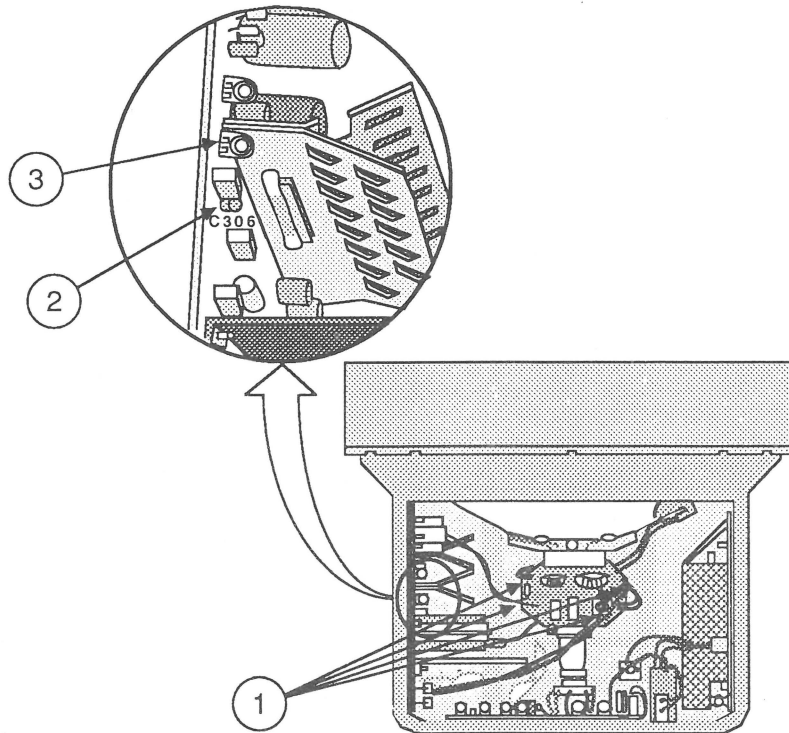


FIGURE 12

3. If the boxes at the top and bottom rows of the monitor screen are not of equal height, use a plastic alignment tool to adjust the VERTICAL LINEARITY control (Figure 12, #3) until the boxes are of equal height.

Vertical Shift

1. Display the **Full White Screen** test pattern on the monitor screen (see "Test Patterns").
2. If the white raster is not vertically centered on the monitor screen, use a plastic alignment tool to adjust the VERTICAL SHIFT control (Figure 13, #1) until the white raster is vertically centered.

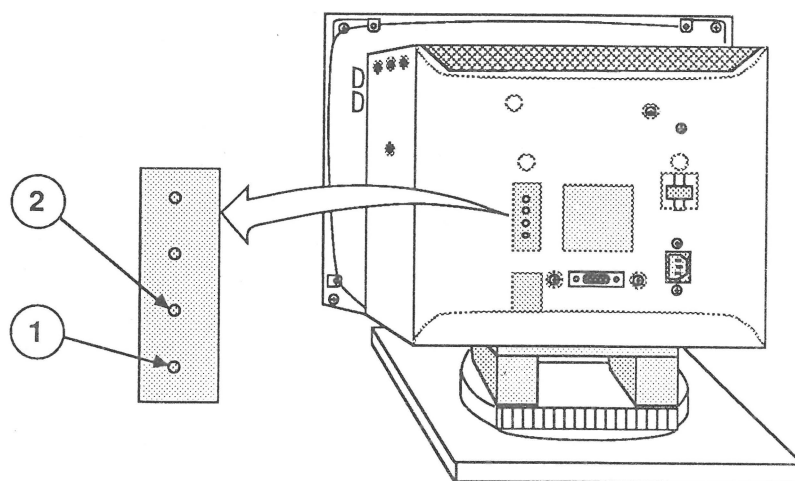


FIGURE 13

Vertical Size (Height)

1. Display the **Full White Screen** test pattern on the monitor screen.
2. If the height of the white raster is not 11 5/16 inches, use a plastic alignment tool to adjust the VERTICAL SIZE control (Figure 13, #2) until the white raster is 11 5/16 inches high.

IMPORTANT: The following procedures, cutoff and screen luminance, should be performed in a dimly lit room after the monitor has been on for at least 20 minutes.

Cutoff

The cutoff procedure should always be performed whenever the video board, the main board, or the CRT is replaced.

1. Turn the power off and **remove the video cable from the back of the monitor.**
2. Set the external CONTRAST control (Figure 14, #1) on maximum (full clockwise).
3. Set the external BRIGHTNESS control (Figure 14, #2) at its center click ("detent") position. To locate the detent position, turn the knob fully clockwise, then counterclockwise. The place in the middle where the knob hesitates is the detent position.

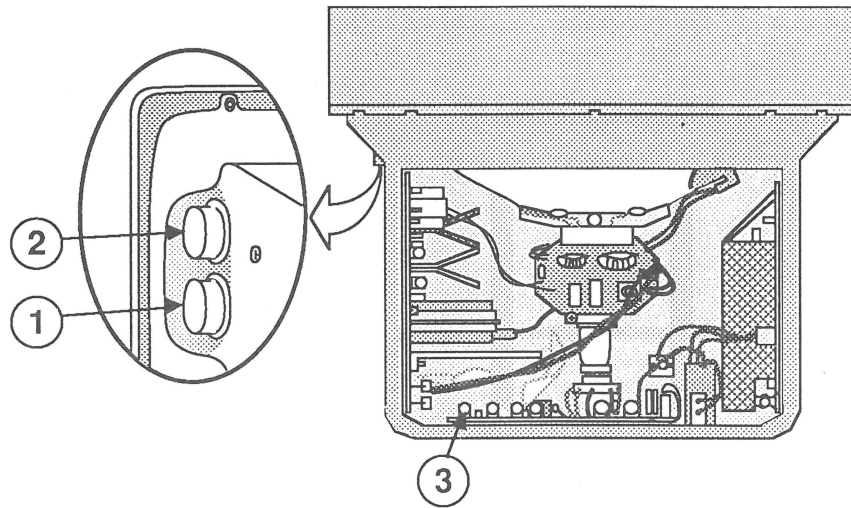


FIGURE 14

4. Using a plastic alignment tool, set the CUTOFF control (Figure 14, #3) on minimum (full counterclockwise). **Turn the power on and wait 20 minutes for the monitor to warm up.**

5. Using a plastic alignment tool, turn the CUTOFF control (Figure 14 #3) clockwise until a white raster just appears, then turn counterclockwise until the raster just fades to black.
6. Turn the power off and reconnect the video cable to the back of the monitor. Then turn the power on.

Note: If the power is turned off for more than a few seconds, you must wait another 20 minutes for the monitor to warm up.

7. Display the **Gray Bars** test pattern on the monitor screen (see "Test Patterns").
8. Using a plastic alignment tool, adjust the CUTOFF control (Figure 14, #3) so that the first bar on the left is solid black and the second bar on the left is dark gray. (The second bar from the left should be just slightly brighter than the first bar.) The cutoff is now properly set.

Screen Luminance

1. **Perform the cutoff procedure if you have not already done so!**
2. Display the **Full White Screen** test pattern on the monitor screen (see "Test Patterns").

...Continued on next page

3. Measure the screen brightness with a light meter:
 - a) Verify that the light meter is functioning correctly by pressing the red button on the back of the meter. If the reading moves to the right of the red notch, replace the battery.
 - b) Move the side switch (Figure 15, #1) down so that the lower scale (Figure 15, #2) reads 2 through 10.
 - c) Uncover the lens of the meter (Figure 15, #3). Place the lens against the screen exactly at screen center and press the "read" button (Figure 15, #4). The reading should fall at the high end of "9" (21 ft.-lamberts) (Figure 15, #5).

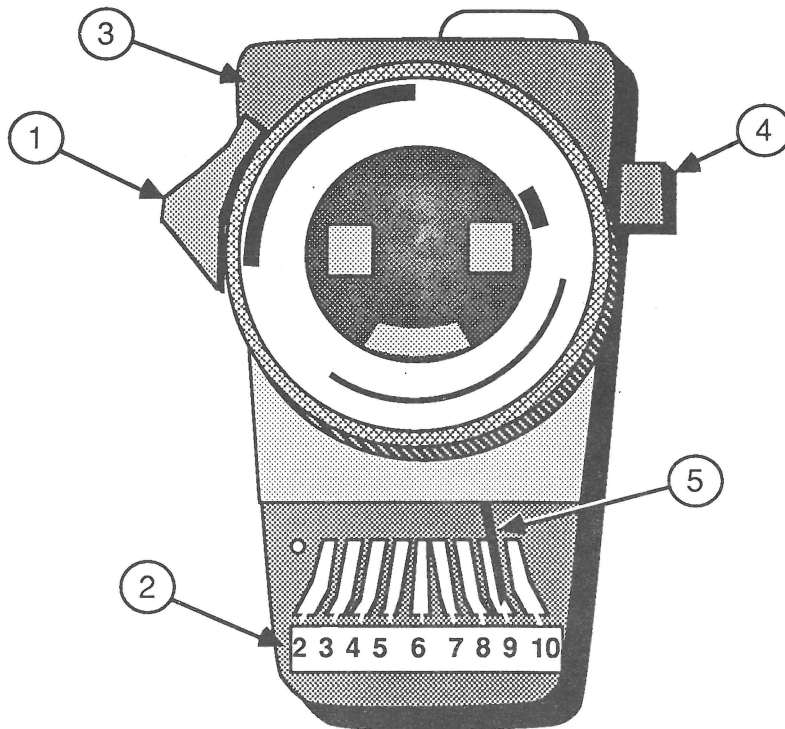


FIGURE 15

4. If the reading is not at the high end of "9," use a plastic alignment tool to adjust the SUBCONTRAST control (Figure 16, #1) until the screen luminance falls at the high end of the "9" on the light meter scale.

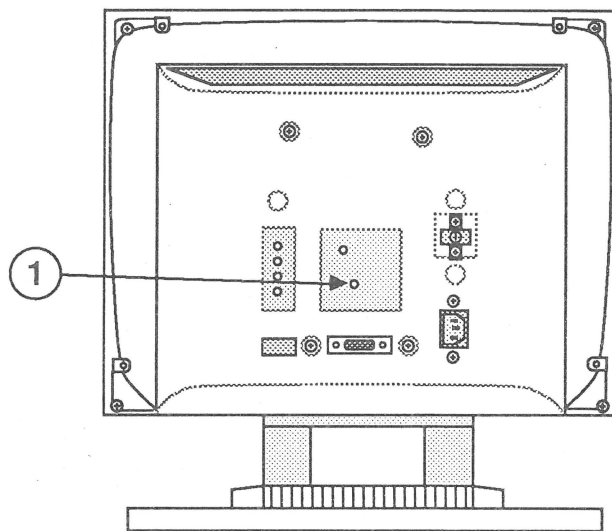


FIGURE 16

5. Set the external BRIGHTNESS control on maximum (full clockwise).
6. Using the plastic alignment tool, adjust the BRIGHTNESS RANGE control (Figure 17, #1) until the screen luminance measures at the low end of the "10" (31 ft.-lamberts) on the light meter scale.

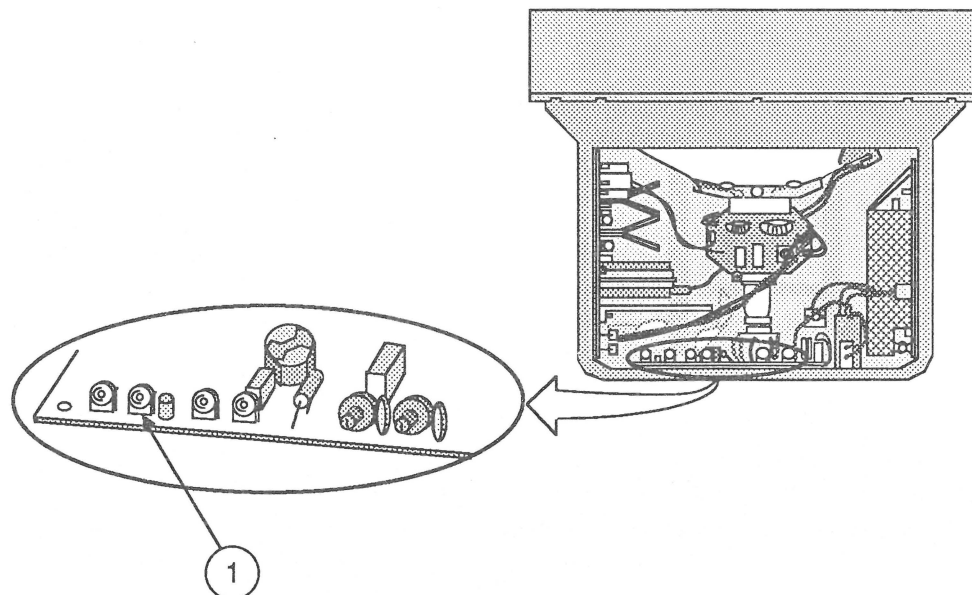


FIGURE 17

7. Reset the external BRIGHTNESS control to its center click ("detent") position.

Focus

1. Display the **Focus** test pattern on the monitor screen (see "Test Patterns").
2. Using the plastic alignment tool, perform the following adjustments to obtain the best overall screen focus:
 - a) Adjust the STATIC FOCUS control (Figure 18, #2) for the best focus in the box at the center of the screen.
 - b) Adjust the HORIZONTAL FOCUS control (Figure 18, #3) for the best focus in the boxes at the left and right sides of the screen.
 - c) Adjust the VERTICAL FOCUS control (Figure 18, #4) for the best focus in the boxes at the top and bottom center of the screen.
 - d) Check for best overall screen focus and readjust STATIC FOCUS, HORIZONTAL FOCUS, and VERTICAL FOCUS if necessary.

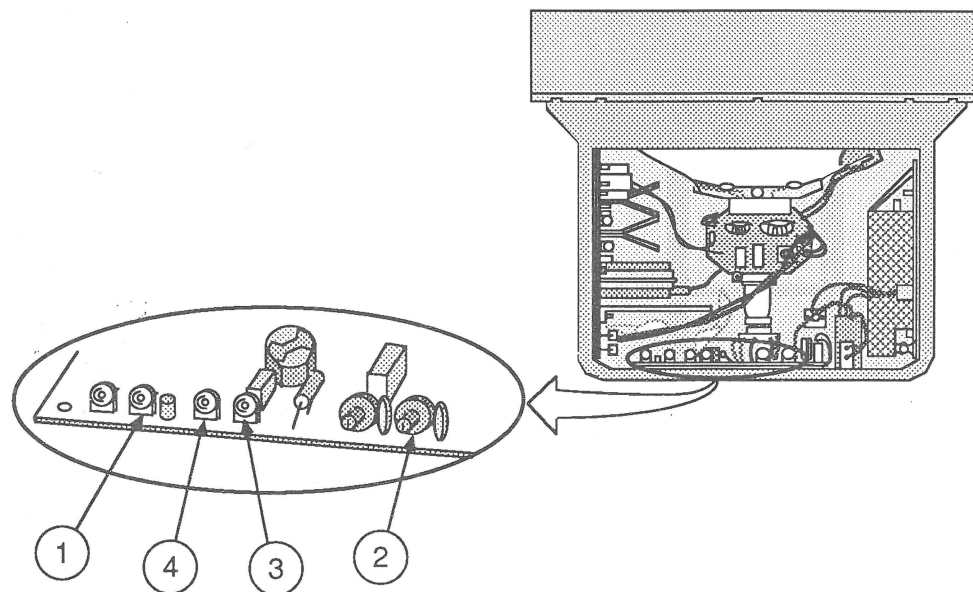


FIGURE 18

□ MACTEST IIcx/IIci TEST PATTERNS

MacTest™ IIcx/IIci tests the video RAM on video cards installed in a Macintosh IIcx or Macintosh IIci, and also displays the test patterns used to adjust the Macintosh II Two-Page Monochrome Monitor.

Materials Required

Macintosh IIcx or Macintosh IIci
Two-Page Monochrome Video Card
MacTest IIcx/IIci disk (version 2.0 or higher)

IMPORTANT: *The Two-Page Monochrome Video Card RAM must be upgraded to 512K in order to display the MacTest IIcx/IIci test patterns.*

Generating the Test Patterns

Follow the steps below to test the video RAM and display the monitor test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh IIcx or Macintosh IIci computer.
2. Boot the *MacTest IIcx/IIci* disk.
3. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect all default test selections.

Note: Apple recommends testing the video RAM before performing the video adjustments.

4. To test the video RAM on the Two-Page Monochrome Video Card, click **Video Card in Slot** and enter the appropriate slot number.
5. To display the video adjustment test patterns, click **Video Monitor Connected to Selected Card**. (Be sure that the correct video card slot is entered in the Video Card in Slot box.)
6. Click **OK** to close the Test Selections window and return to the Start window.

7. From the Start window, click **Start** to proceed. You will encounter one or both of these scenarios:

- If you chose to test the Two-Page Monochrome Video Card, the following message will appear on the main monitor: **Testing Macintosh II Two-Page Monochrome Video Card**. Horizontal and vertical lines will flash across the screen of the Two-Page Monochrome Monitor. After about one minute, the Status line in the Start window on the main monitor will indicate whether the video card has passed or failed the test. Clicking **Start** again will display the first test pattern (if selected) or rerun the video card test.
- If you chose to display only the monitor test patterns, the first (gray bars) test pattern will be displayed on the Two-Page Monitor screen. Click the mouse to advance through the test patterns (each test pattern is displayed once). When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)

8. *MacTest IIcx/IIci* displays these test patterns:

- Gray Bars
- Full White Screen
- Full Black Screen
- Crosshatch I (black background)
- Crosshatch II (white background)
- Focus

Apple Two-Page Monochrome Monitor

Section 4 – Troubleshooting

□ CONTENTS

- 4.2 Introduction
- 4.2 Symptom Chart

□ INTRODUCTION

In this section you will find a symptom chart for the Apple Two-Page Monochrome Monitor. This symptom chart lists common problems that may occur with the Apple Two-Page Monochrome Monitor and their solutions. Find the description that best matches the symptom(s) displayed by the Apple Two-Page Monochrome Monitor, and perform the corrective actions in the order they are listed.

If the first action does not fix the problem, try the next action on the list. If you replace a module and the problem still exists, reinstall the original module or part before performing the next repair action.

□ SYMPTOM CHART

Problem	Solution
<ul style="list-style-type: none">• <i>No power</i> (LED does not light)	<ol style="list-style-type: none">1. Check that the AC power cord is properly connected.2. Check internal power connectors.3. Check power supply fuse and replace if blown. If fuse blows again, go to the next step.4. Replace the power supply.5. Replace on-off switch filter assembly.6. Replace the main board.
<ul style="list-style-type: none">• <i>No raster</i>	<ol style="list-style-type: none">1. Adjust the brightness and contrast control knobs.2. Make sure that all connectors are secure on the power supply and main board.3. Make sure the CRT socket connectors are tight.4. Check power supply fuse and replace if blown. If fuse blows again, go to the next step.5. Replace the power supply.6. Replace the main board.7. Replace the video board.8. Replace the CRT and yoke assembly.

Problem

Solution

- *No video*
 1. Connect another monitor to the computer and power on to verify that a video signal is coming from the computer.
 2. Check that the video cable is securely connected.
 3. Adjust the brightness and contrast control knobs.
 4. Make sure that all connectors are secure on the video board and main board.
 5. Replace the video board.
 6. Replace the main board.

- *Single horizontal line appears*
 1. Make sure that the yoke connectors are secure.
 2. Make sure the CRT socket connectors are tight.
 3. Replace the main board.
 4. Replace the CRT and yoke assembly.

- *Single vertical line appears*
 1. Make sure that the yoke connectors are secure.
 2. Make sure the CRT socket connectors are tight.
 3. Replace the main board.
 4. Replace the CRT and yoke assembly.

- *Raster not centered*
 1. Adjust HORIZONTAL SHIFT and VERTICAL SHIFT controls as described in Section 3, Adjustments.
 2. Replace video board.

- *Raster size small*
 1. Adjust HORIZONTAL SIZE (Width) and VERTICAL SIZE (Height) controls as described in Section 3, Adjustments.
 2. Replace the main board.
 3. Replace the power supply.

- *Horizontal linearity bad*
 1. Adjust HORIZONTAL LINEARITY control as described in Section 3, Adjustments.
 2. Replace the main board.

- *Vertical linearity bad*
 1. Adjust VERTICAL LINEARITY control as described in Section 3, Adjustments.
 2. Replace the main board.

Problem

Solution

- *Picture rolls vertically*
 1. Connect another monitor to the computer and power on to verify that a video signal is coming from the computer.
 2. Make sure all connectors are secure on the video board and the main board.
 3. Replace the main board.
 4. Replace the video board.

- *Picture breaks in diagonal lines*
 1. Connect another monitor to the computer and power on to verify that a video signal is coming from the computer.
 2. Confirm that all connectors from the video board to the main board are properly connected and secure.
 3. Replace the main board.
 4. Replace the video board.

- *Picture too dark or too bright*
 1. Adjust external CONTRAST and BRIGHTNESS controls.
 2. Confirm that the CONTRAST-BRIGHTNESS connector is properly connected to the video board.
 3. Replace the video board.
 4. Replace the CONTRAST-BRIGHTNESS assembly.
 5. Replace the CRT and yoke assembly.

- *Picture jitters or flashes*
 1. Make sure that all connectors are secure on the video board and main board.
 2. Make sure that the CRT grounding wire is properly connected.
 3. Replace the video board.
 4. Replace the main board.
 5. Replace the power supply.

- *Contrast-Brightness cannot be adjusted*
 1. Confirm that the CONTRAST-BRIGHTNESS connector is properly connected to the video board.
 2. Replace the CONTRAST-BRIGHTNESS assembly.
 3. Replace the video board.
 4. Replace the main board.
 5. Replace the CRT and yoke assembly.

Problem

Solution

- *Black spots on screen (burnt phosphor)*
 - Replace the CRT and yoke assembly.
- *Out of focus*
 - 1. Make sure the CRT socket connectors are tight.
 - 2. Ensure that all connectors are secure on the video board and main board.
 - 3. Perform FOCUS adjustment as described in Section 3, Adjustments.
 - 4. Check screen brightness with a light meter. If the meter reading is at "10" or higher, perform the CUTOFF and SCREEN LUMINANCE adjustments as described in Section 3, Adjustments.
 - 5. Replace the video board.
 - 6. Replace the main board.
 - 7. Replace the CRT and yoke assembly.
- *Monitor stand does not swivel*
 - 1. Verify that the "Front" indicator on the tilt-swivel mechanism lines up with the "Front" indicator on the base of the monitor stand.
 - 2. Verify that the snap lock assembly on the bottom of the monitor stand is in place.
- *Monitor stand does not tilt*
 - 1. Verify that the plastic plug is inserted into the snap lock assembly.
 - 2. Verify that the snap lock assembly on the bottom of the monitor stand is in place.

Apple Two-Page Monochrome Monitor

Illustrated Parts List

□ CONTENTS

IPL.3 Apple Two-Page Monochrome Monitor
(Figure 1)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple Two-Page Monochrome Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

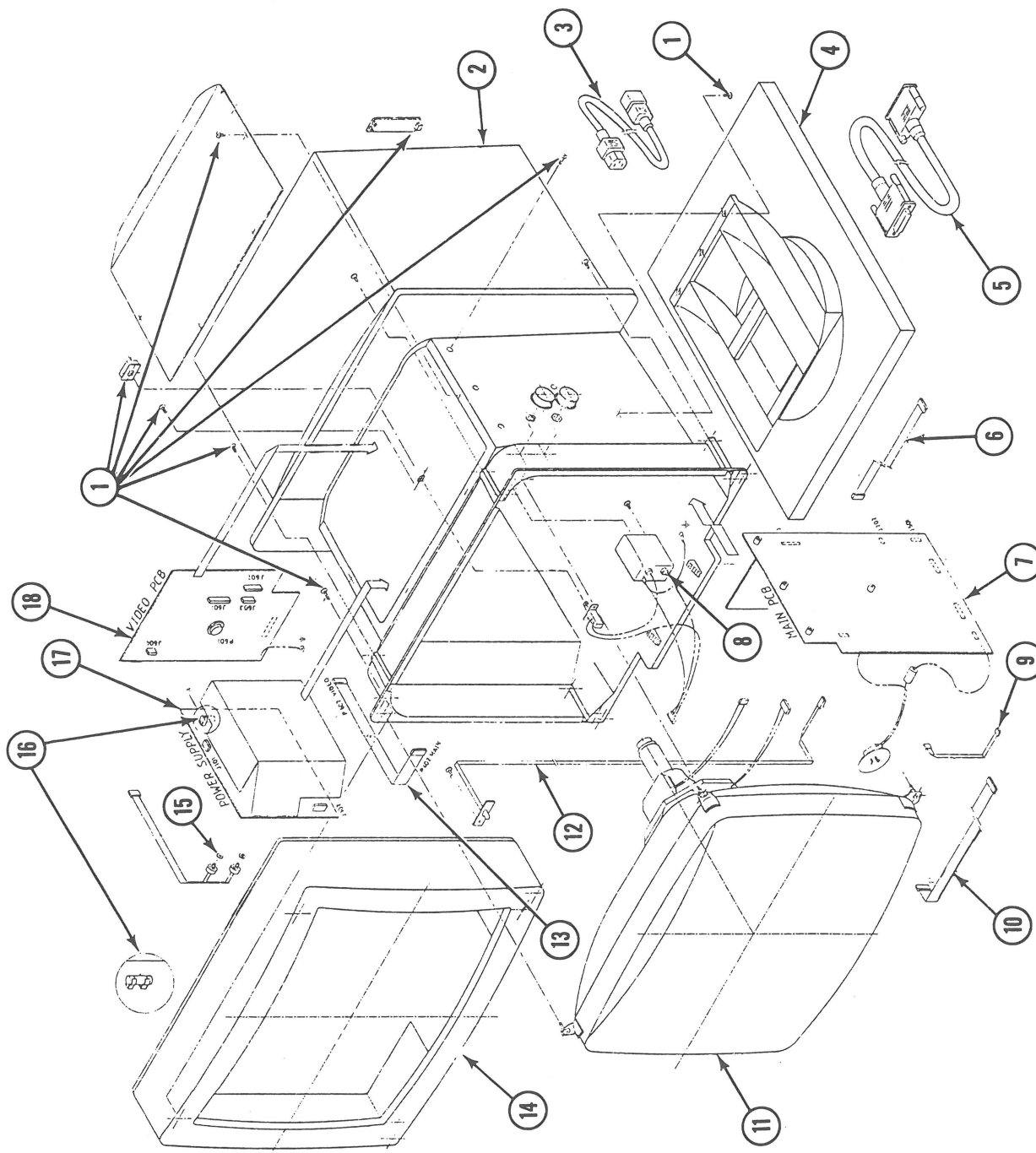


FIGURE 1

□ APPLE TWO-PAGE MONOCHROME MONITOR (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	956-0012	Screw/Knob Set
2	949-0224	Rear Cover, Plastic
3	590-0371	Cable, Power, 1.9m, U.S.
4	815-0558	Tilt Swivel Monitor Stand
5	590-0574	Cable, Video, DB25 to DB25 (used with 661-0452)
	590-0615	Cable, Video, DB15 to DB25 (used with 661-0608)
6	590-0393	Cable, Power Supply, 6-pin
7	661-0451	Main Board
8	937-0040	On/Off Switch Filter Assembly
9	590-0397	Cable, Main Board/Video Board, 3-pin
10	590-0398	Cable, Flat, Main Board/Video Board, 14-pin
11	076-0320	CRT Assembly (Includes Yoke Assembly)
12	590-0391	Cable Assembly, LED
13	590-0395	Cable, Flat, Main Board/Video Board, 12-pin
14	949-0223	Bezel, Plastic Case
15	905-0007	Contrast Brightness Assembly
16	941-0016	Fuse, 2.5 Amp, 250V, 5/pk
17	661-0453	Power Supply
18	661-0452	Video Board

Apple Macintosh Portrait Display

Technical Procedures

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- 4.4 Symptom Chart
- 4.4 Raster Problems
- 4.5 Video Display Problems
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Illustrated Parts List

- IPL.3 System Exploded View (Figure 1)

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Apple Macintosh Portrait Display

Section 1 – Basics

❏ CONTENTS

- 1.3 Product Description
- 1.4 External Controls
- 1.5 External Connectors
- 1.6 Module Identification
- 1.8 Care and Handling

□ PRODUCT DESCRIPTION

The Apple® Macintosh® Portrait Display is a high-resolution, 15-inch (diagonal) monochrome monitor that can be used with any Macintosh computer with NuBus expansion slots. A Macintosh II Portrait Video Card is required to operate the Portrait Display (refer to *Macintosh Family Cards Technical Procedures* for more information about the video card).

The Macintosh Portrait Display features a full-page display and 80 DPI (dots per inch) resolution, which makes it an ideal Macintosh companion for performing word processing and desktop publishing applications. The Portrait Display also features:

- A flat-faced, square-cornered picture tube for page-like display
- 640 horizontal by 870 vertical pixels
- A crisp, flicker-free display
- A high-contrast, antiglare screen
- Up to 16 shades of gray (with video card expansion kit)
- A universal power supply
- 75 Hz refresh rate
- Three ADB (Apple Desktop Bus™) ports
- Compatibility with Apple Universal Monitor Stand

External Controls

The power switch (Figure 1, #1), contrast control (Figure 1, #2), and brightness control (Figure 1, #3) are the only controls recommended for user access. The brightness control has a detent for midrange reference. A yellow LED at the lower-right, front corner of the bezel indicates when power to the Portrait Display is on.

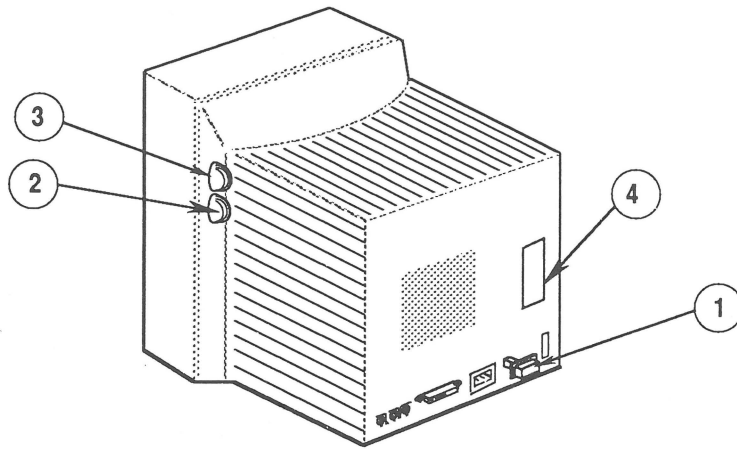


FIGURE 1

Three adjustment controls are at the back of the Portrait Display, under a snap-out door (Figure 1, #4). These are not user controls, but well-meaning users may sometimes misalign them. The internationally recognized symbols shown in Figure 2 are used to identify these three external adjustment controls:

- H.CENT (horizontal centering) (Figure 2, #1)
- HEIGHT (Figure 2, #2)
- V.CENT (vertical centering) (Figure 2, #3)

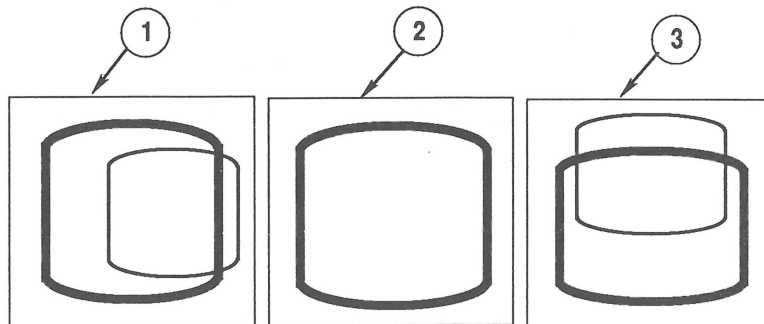


FIGURE 2

External Connectors

Five external connectors (including three Apple Desktop Bus ports) and the opening for an attachable security lock are located at the back of the Macintosh Portrait Display, as follows:

- Three ADB ports (Figure 3, #1)
- Video connector (Figure 3, #2)
- Power socket (Figure 3, #3)
- Security lock opening (Figure 3, #4)

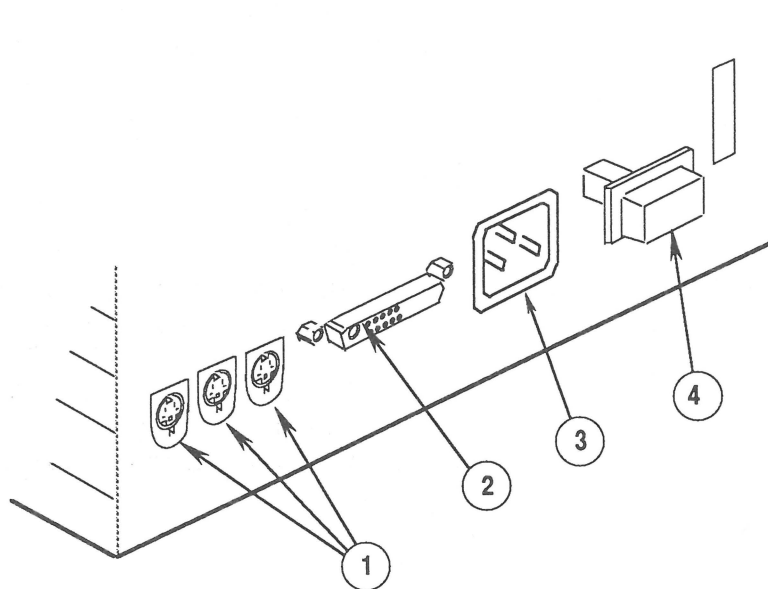


FIGURE 3

The three ADB ports enable users to connect ADB input devices (such as a keyboard or mouse) directly to the Portrait Display. The ADB ports provide a path for information to flow from the input device through the monitor to the computer, which allows the user to separate desktop devices from the CPU. This frees space on the desktop, and provides a greater variety of possible system configurations. (The Macintosh II Portrait Video Card comes with an extended-length ADB cable for connecting ADB devices to the monitor.)

□ MODULE IDENTIFICATION

The Macintosh Portrait Display is designed for ease of maintenance and servicing. Board screening and color-coding has been used throughout, and adjustment controls are easy to access and identify (their labels are stamped on the outside of the chassis and EMI shield). The monitor chassis has also been designed with side panels that can be swung open (see Figure 4) to improve access to interior components. No new tools are required to repair and service the Portrait Display.

The Portrait Display includes the following exchange modules and replaceable parts:

- CRT (Figure 4, #1)
- Main deflection board (Figure 4, #2)
- AC input assembly (with fuse) (Figure 4, #3)
- CRT board (Figure 4, #4)
- Signal input assembly (Figure 4, #5)
- Video board (Figure 4, #6)
- Fan (Figure 4, #7)
- Contrast brightness board (Figure 4, #8)

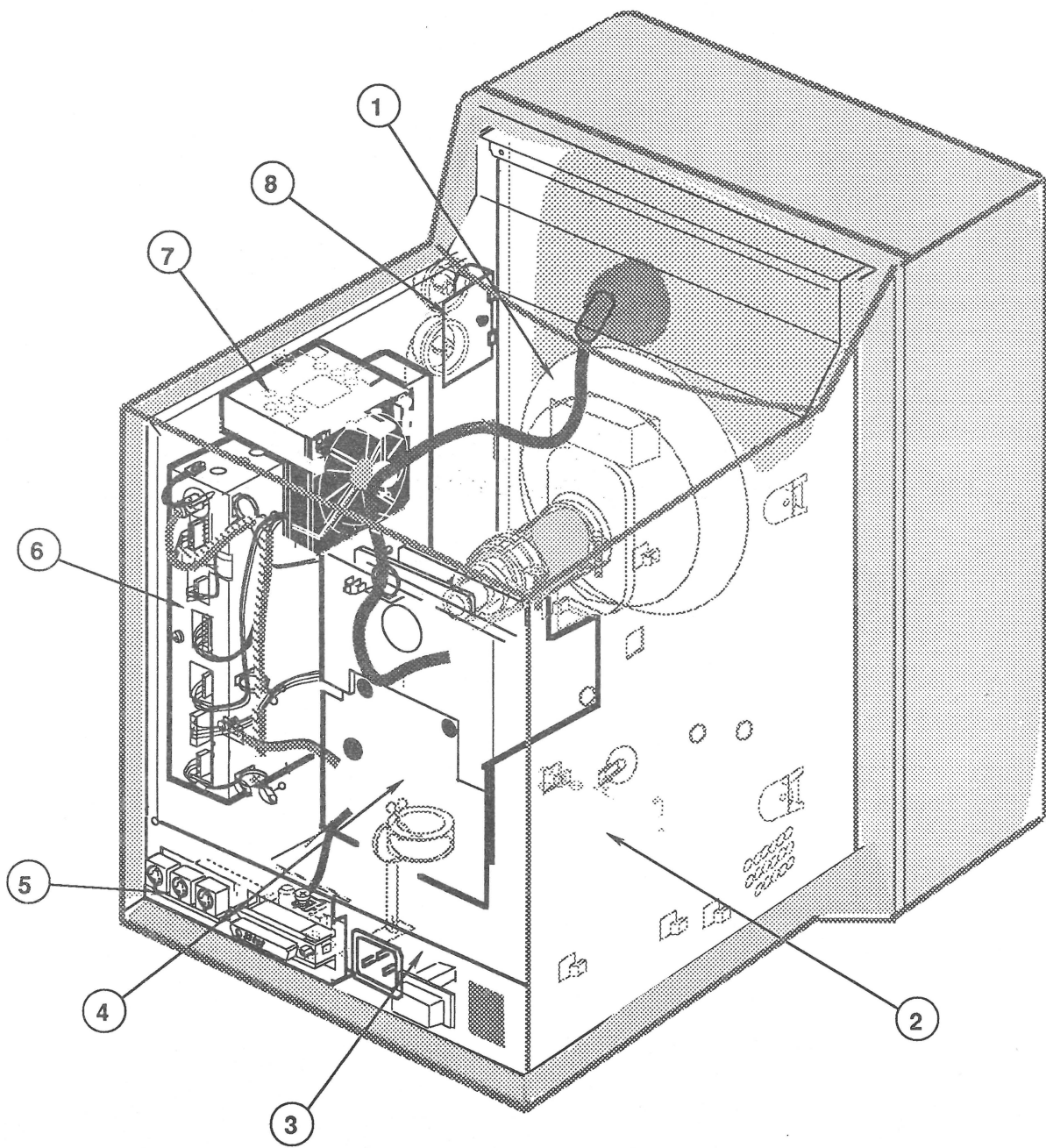


FIGURE 4

□ CARE AND HANDLING

The Apple Macintosh Portrait Display is a complex precision instrument that must be handled with care to ensure perfect operation. Dropping the monitor, however slightly, can cause CRT alignment problems.

Keep service modules and finished-goods monitors in the Apple packaging until use, and return modules to Apple for repair packed in approved module packaging.

The Apple Macintosh Portrait Display contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

Apple Macintosh Portrait Display

Section 2 – Take-Apart

□ CONTENTS

2.2	Rear Cover
2.3	Electromagnetic Interference (EMI) Shield
2.6	Discharging the Cathode-Ray Tube (CRT)
2.6	Discharging Procedure
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2.12	Fuse
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2.17	Fan
2.20	Video Board
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2.28	CRT Board
2.37	Main Deflection Board
2.44	Bezel
2.46	LED Cable Assembly
2.51	Cathode-Ray Tube (CRT)

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ REAR COVER

WARNING: The Apple Macintosh Portrait Display contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the rear cover. Failure to follow the safety rules could result in serious injury.

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off the monitor and disconnect the AC power cord and video cable. Place the monitor face down on a soft, protective surface to avoid damaging the CRT screen.

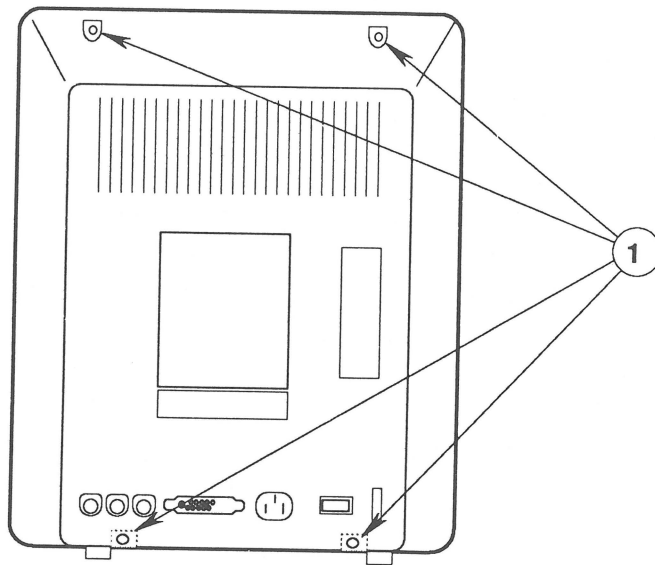


FIGURE 1

2. Remove the four case screws (Figure 1, #1) and lift the rear cover off the bezel.

Replace

1. Carefully set the monitor face down on a soft, protective surface.
2. Slide the rear cover onto the bezel, and replace the four case screws (Figure 1, #1).

□ ELECTROMAGNETIC INTERFERENCE (EMI) SHIELD

Materials Required

Medium Phillips screwdriver

The EMI shield consists of two metal panels secured to the top and rear of the monitor chassis. Both panels must be removed to discharge and repair the Macintosh Portrait Display. Most monitor adjustments can be performed without removing the EMI shield.

Remove

1. Remove the cover.

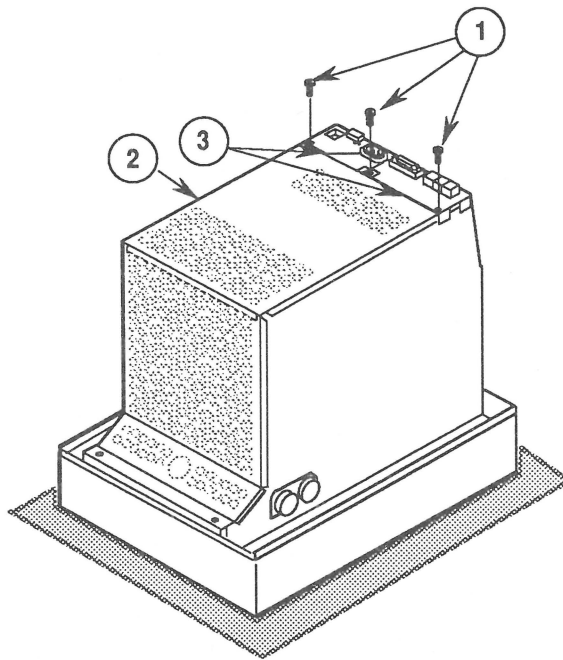


FIGURE 2

2. Remove the three screws (Figure 2, #1) from the rear panel of the EMI shield (Figure 2, #2).
3. Slightly lift the two metal brackets (Figure 2, #3), and then slide out and lift the rear panel off the chassis.

4. Pull up and remove the top panel of the EMI shield (Figure 3, #1) from the chassis.

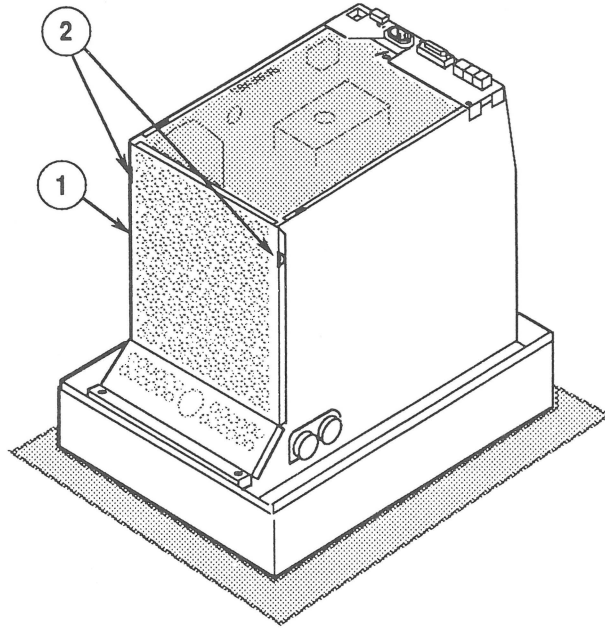


FIGURE 3

Replace

1. Replace the top panel of the EMI shield (Figure 3, #1) on the chassis. To do this, insert the two panel tabs (Figure 3, #2) into the two slots in the chassis, and push the panel down to seat it on the chassis.
2. Slightly lift the two metal brackets (Figure 4, #1), and slide the notched end of the rear panel of the EMI shield (Figure 4, #2) under the brackets.
3. Insert the two panel tabs (Figure 4, #3) into the two slots in the chassis, and push the panel down to seat it on the chassis.

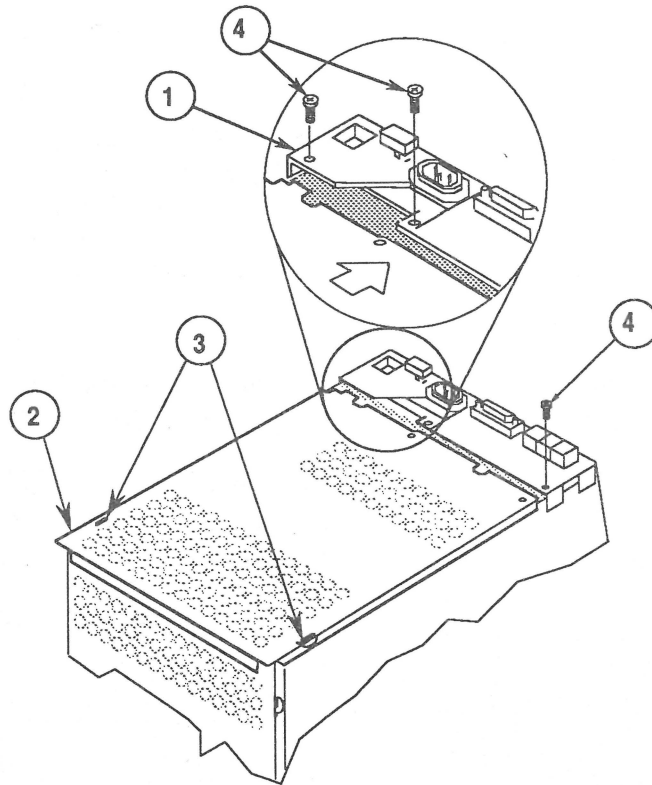


FIGURE 4

4. Replace the three screws (Figure 4, #4).
5. Replace the cover.

❑ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The Macintosh Portrait Display has a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. **Follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.**

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number 076-0381)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the You Oughta Know tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are also given in that section.

Discharge Procedure

1. Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!

WARNING: Do not touch the yoke wires (Figure 5, #1), the anode wire (Figure 5, #2), the anode connector (Figure 5, #3), or the flyback transformer (Figure 5, #4).

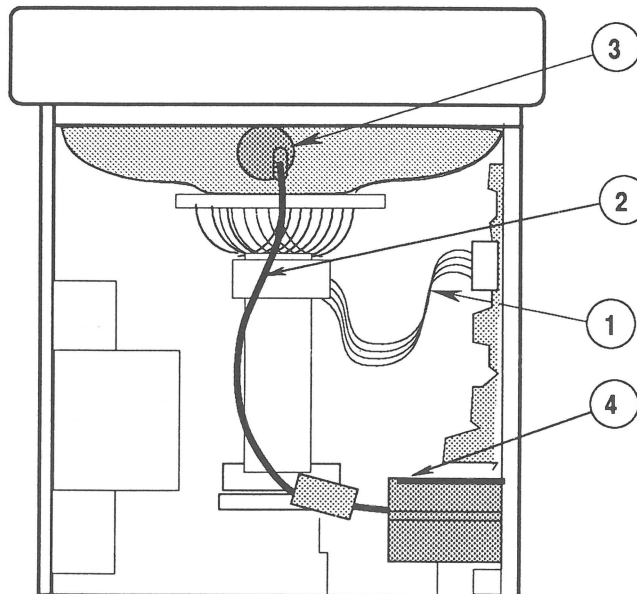


FIGURE 5

2. Remove the rear cover and the EMI shield.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

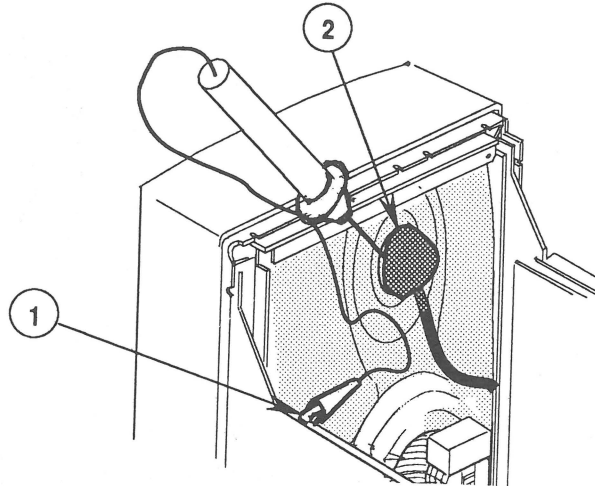


FIGURE 6

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 6, #1).
5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 6, #2) until it touches the anode ring.
7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

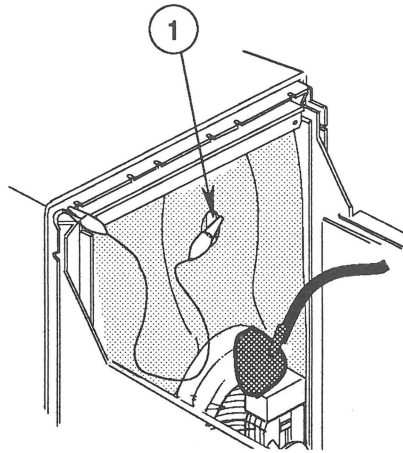


FIGURE 7

Note: If the bleeder resistor fails, a secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode aperture (Figure 7, #1).

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

□ AC INPUT ASSEMBLY

Materials Required

Medium Phillips screwdriver
Small wire cutters
Tie-wrap

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the screw (Figure 8, #1) that secures the black ground wire (Figure 8, #2) to the AC input assembly mounting bracket (Figure 8, #3). Push the wire through the hole in the mounting bracket.

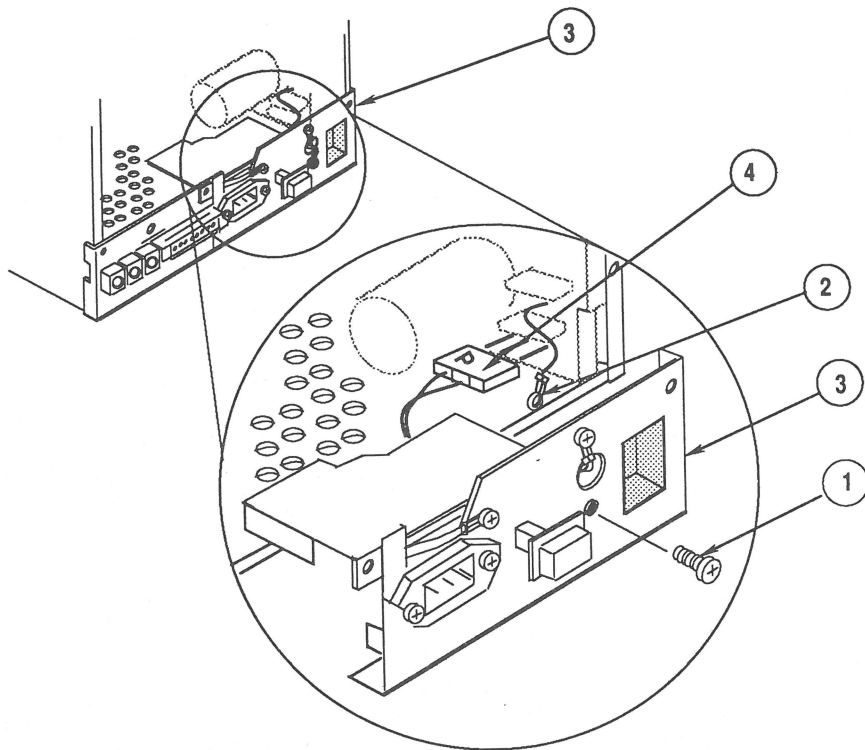


FIGURE 8

5. Lift the AC input assembly away from the chassis, and disconnect the **P** connector (Figure 8, #4) from the main deflection board.

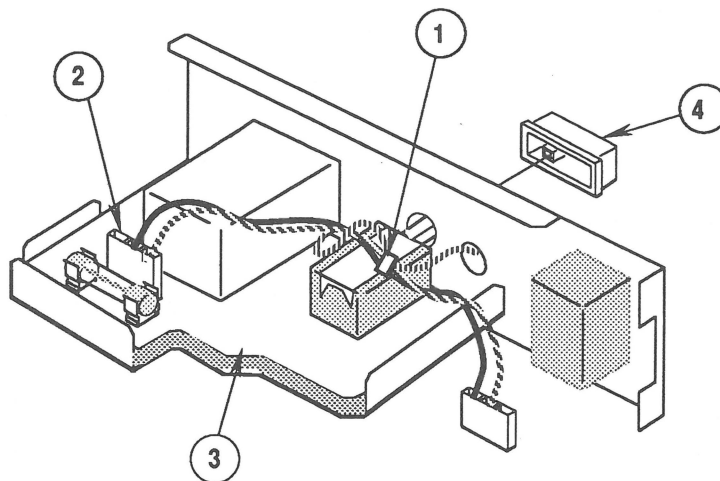


FIGURE 9

Note: Stop here if you are removing the AC input assembly to access another component only.

6. Cut the tie-wrap (Figure 9, #1), and remove the **P** connector (Figure 9, #2) from the AC input board (Figure 9, #3). Keep the **P** connector.
7. Pull the plastic knob (Figure 9, #4) off the On/Off switch. Keep the knob.

Note: When returning a defective AC input assembly to Apple, be sure to remove and keep the plastic On/Off knob, the **P** connector, and the fuse (refer to the "Fuse" procedure, which follows). Install these items on the replacement AC input assembly.

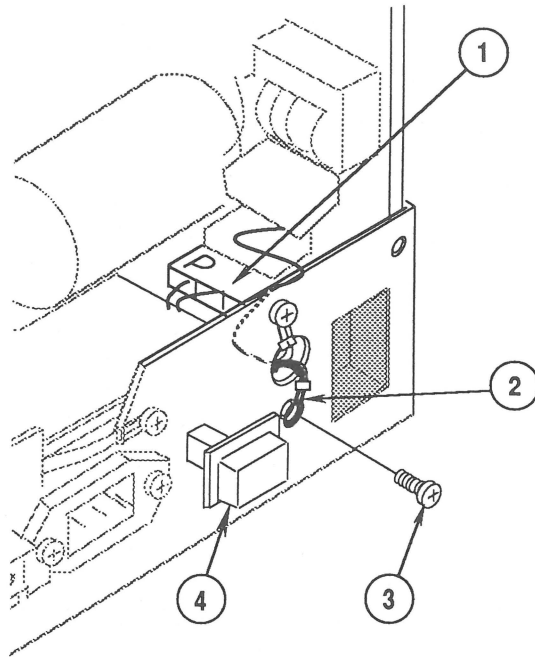


FIGURE 10

Replace

1. Reconnect one end of the **P** connector (Figure 9, #2) to the AC input board (Figure 9, #3), and install a new tie-wrap (Figure 9, #1) around the AC input assembly wires.
2. Reconnect the other end of the **P** connector (Figure 10, #1) to the main deflection board.
3. Pull the black ground wire (Figure 10, #2) through the hole in the AC input assembly mounting bracket.
4. Replace the AC input assembly on the chassis, and replace the ground wire and screw (Figure 10, #3).
5. Replace the plastic knob (Figure 10, #4) on the On/Off switch.
6. Replace the EMI shield and the rear cover.

□ FUSE

Materials Required

Medium Phillips screwdriver
Small flat-blade screwdriver

Remove

1. Remove the rear cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
5. Remove the AC input assembly.

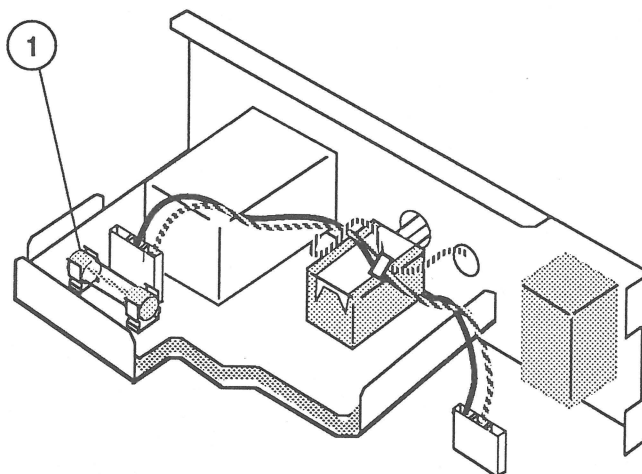


FIGURE 11

6. Remove the fuse (Figure 11, #1). Gently pry up one end of the fuse with your fingers or a flat-blade screwdriver and lift the fuse out.

Replace

1. Carefully snap the new fuse (Figure 11, #1) into the fuse holder with your fingers.
2. Replace the AC input assembly.
3. Replace the EMI shield.
4. Replace the rear cover.

□ SIGNAL INPUT ASSEMBLY

Materials Required

Medium Phillips screwdriver
Small needlenose pliers

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Locate the two signal input cables (Figure 12, #1 and #2) that are connected to the upper corner of the video board assembly (Figure 12, #3).

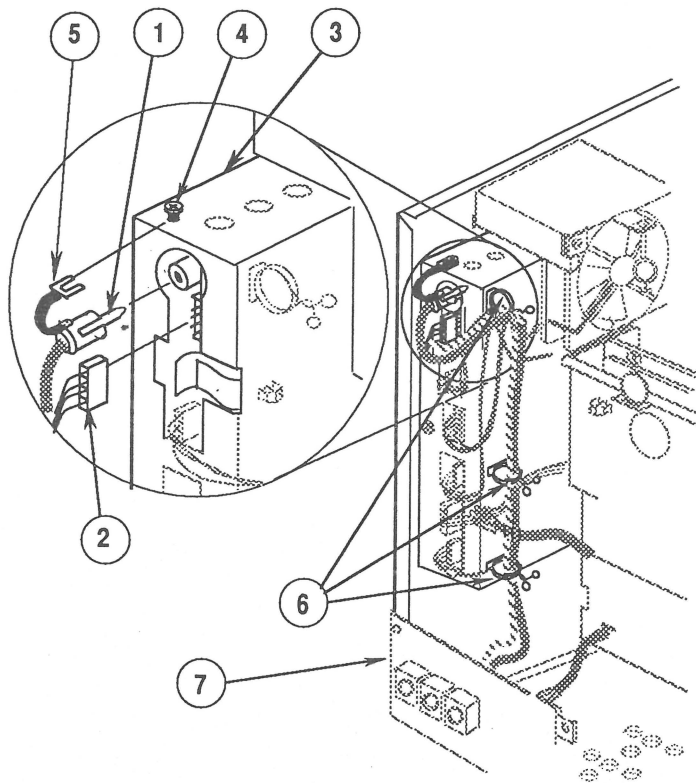


FIGURE 12

5. Loosen the screw (Figure 12, #4) on the video board assembly, and remove the black ground cable (Figure 12, #5) that is attached to the signal input assembly video cable (Figure 12, #1).

6. Disconnect the following connectors from the video board:

- Black video cable (with attached ground cable) (Figure 12, #1)
- 4-wire connector (Figure 12, #2)

Remove the video cable and the 4-wire connector cable from the three cable clamps (Figure 12, #6).

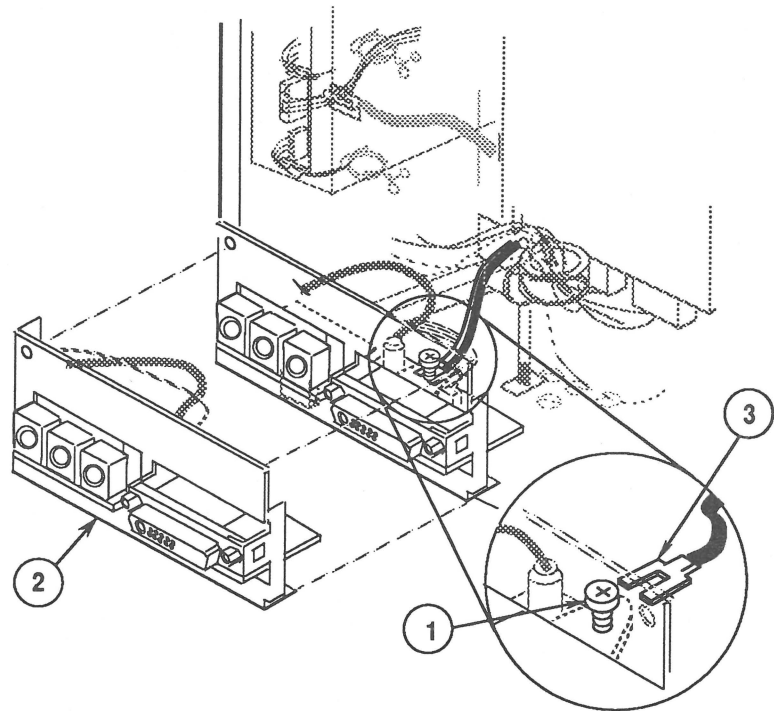


FIGURE 13

7. Loosen the screw (Figure 13, #1) on the signal input assembly mounting bracket (Figure 13, #2), and remove the black ground cable (Figure 13, #3). Lift the signal input assembly off the chassis.

Replace

1. Replace the signal input assembly on the chassis. Then replace the black ground cable (Figure 13, #3) on the signal input assembly mounting bracket, and tighten the screw (Figure 13, #1).

2. Lace the two signal input assembly cables up through the three cable clamps (Figure 14, #1) to the video board. Close the cable clamps.

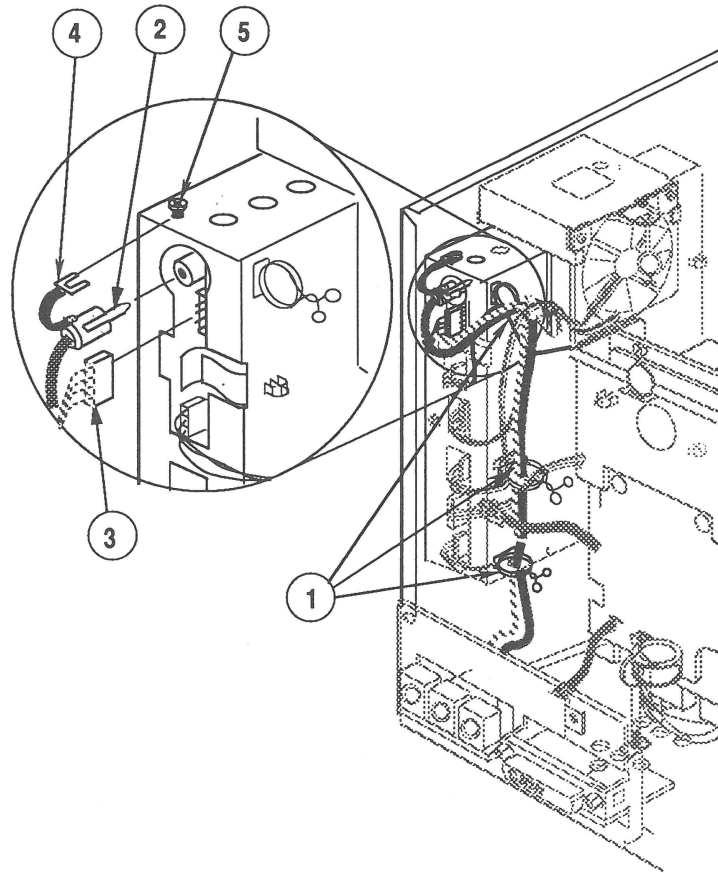


FIGURE 14

3. Reconnect the following connectors to the video board assembly:
 - Black video cable (Figure 14, #2)
 - 4-wire connector (Figure 14, #3)
4. Replace the black ground cable (Figure 14, #4) and tighten the screw (Figure 14, #5).
5. Replace the EMI shield and the rear cover.

□ FAN

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
5. Open the four cable clamps (Figure 15, #1).
6. Remove the screw (Figure 15, #2) that secures the fan mounting bracket (Figure 15, #3) to the chassis. Carefully remove the mounting bracket, fan, and wire.

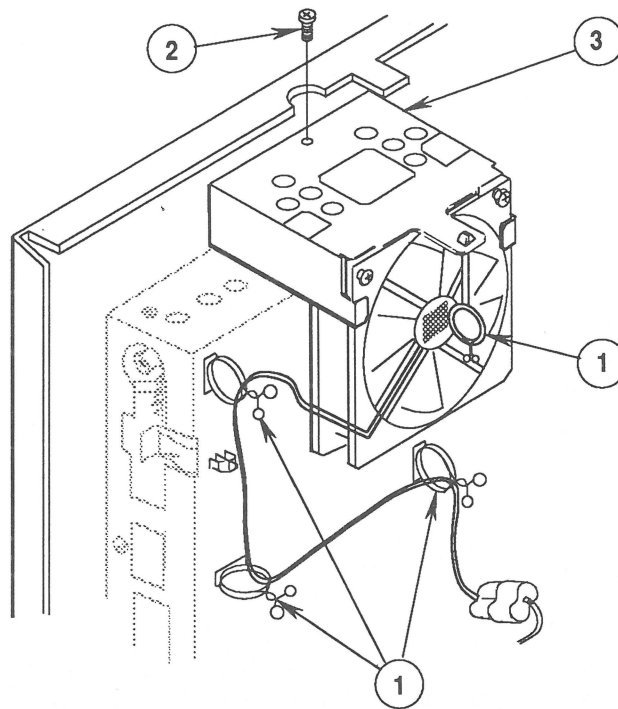


FIGURE 15

7. Disconnect the fan wires at the fan connectors (Figure 16, #1), and remove the fan and mounting bracket.

Note: Stop here if you are removing the fan assembly to access another component only.

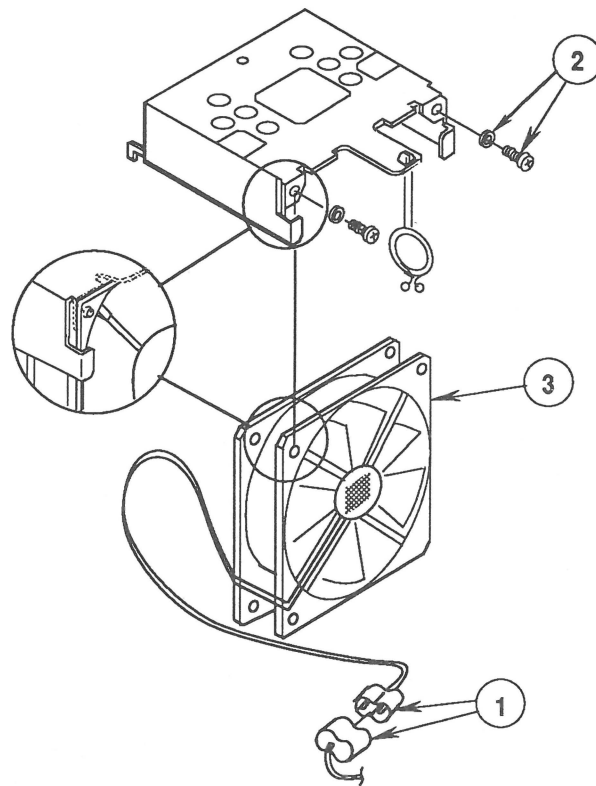


FIGURE 16

8. Remove the two screws and lockwashers (Figure 16, #2), and remove the fan (Figure 16, #3) from the mounting bracket.

Replace

1. Replace the fan (Figure 16, #3) on the mounting bracket (see detail), and install the two lockwashers and screws (Figure 16, #2).
2. Replace the fan mounting bracket on the chassis. To do this, insert the two bracket tabs (Figure 17, #1) into the two slots in the chassis, and replace the screw (Figure 17, #2).

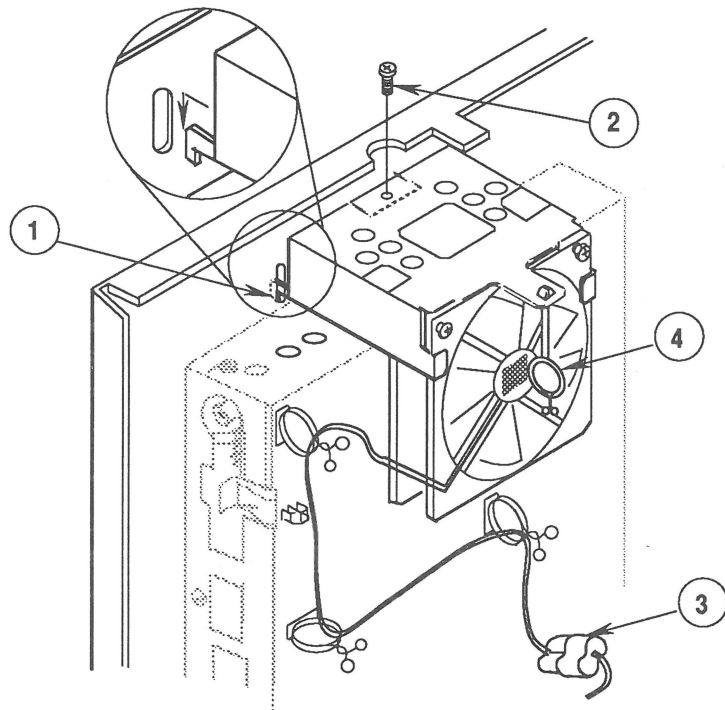


FIGURE 17

3. Reconnect the fan wires at the fan connectors (Figure 17, #3).
4. Replace the fan wires in three cable clamps as shown in Figure 17, and replace the anode wire in the fourth clamp (Figure 17, #4). Close the clamps.
5. Replace the EMI shield.
6. Replace the rear cover.

□ VIDEO BOARD

Materials Required

Medium Phillips screwdriver
Needlenose pliers

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the signal input assembly and the fan.
5. Remove these connectors from the video board:
 - 3-wire connector labeled **S** (Figure 18, #1)
 - 6-wire connector labeled **C** (Figure 18, #2)
 - 5-wire connector labeled **H** (Figure 18, #3)
 - 3-wire connector labeled **K** (Figure 18, #4)
 - 4-wire connector labeled **O** (Figure 18, #5)

Remove all connector wires from cable clamps.

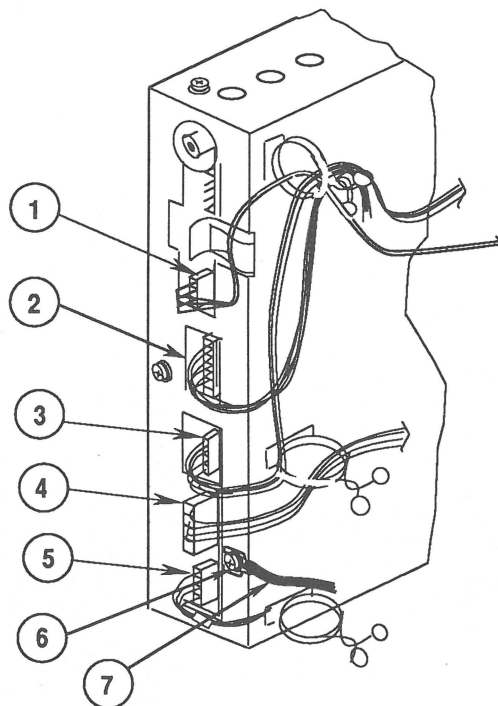


FIGURE 18

6. Loosen the screw (Figure 18, #6) on the video board case, and remove the black ground cable (Figure 18, #7).

Note: Both side panels of the chassis are hinged and can be swung open to improve access to components.

7. Pull open slightly (see Figure 19) the left chassis panel to access the two cables (Figure 19, #1 and #2) at the bottom and front of the video board.

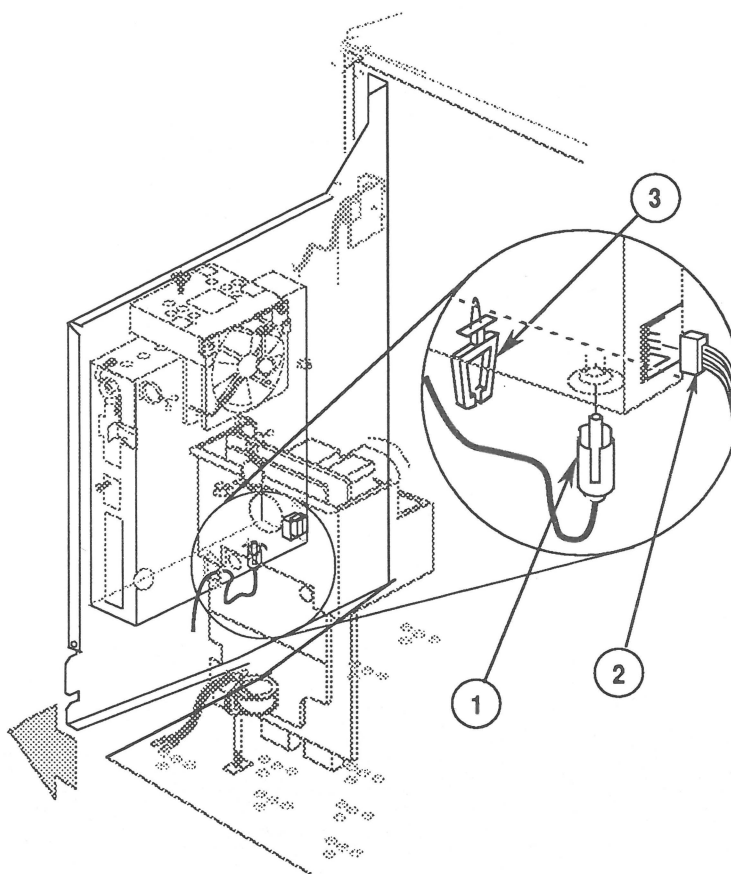


FIGURE 19

8. Remove the video cable (Figure 19, #1) from the cable clamp (Figure 19, #3) beneath the video board case, and disconnect the cable from the video board.
9. Disconnect the small LED connector (Figure 19, #2) from the video board.

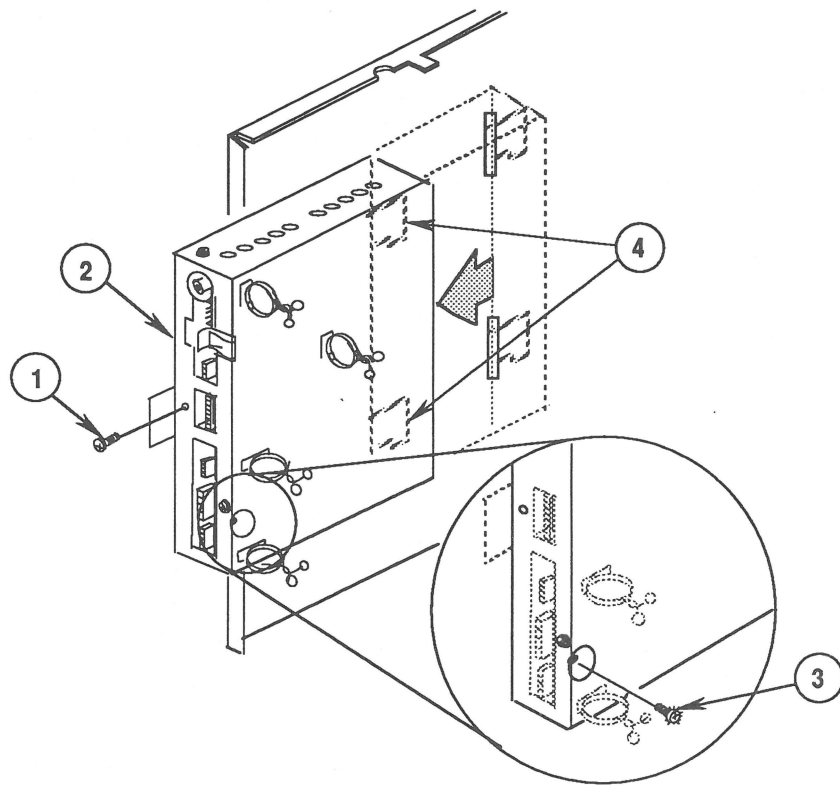


FIGURE 20

10. Remove the screw (Figure 20, #1) that secures the video board case (Figure 20, #2) to the chassis, and remove the case with the video board.
11. Remove the video board mounting screw (Figure 20, #3) through the back of the video board case.
12. Using needlenose pliers, remove the plastic cable clamp (Figure 21, #1) from the bottom of the video board case.
13. Place the video board assembly board-side-up on the workbench. Depress the three plastic standoffs (Figure 21, #2), and remove the video board from the metal case.

Replace

1. Replace the video board in the metal case.
To do this, insert the right edge of the video board (the edge with the connectors) under the small case mounting bracket (Figure 21, #3), and push the board down until it snaps into place beneath the three plastic standoffs (Figure 21, #2).
2. Replace the cable clamp (Figure 21, #1) in the bottom of the case.

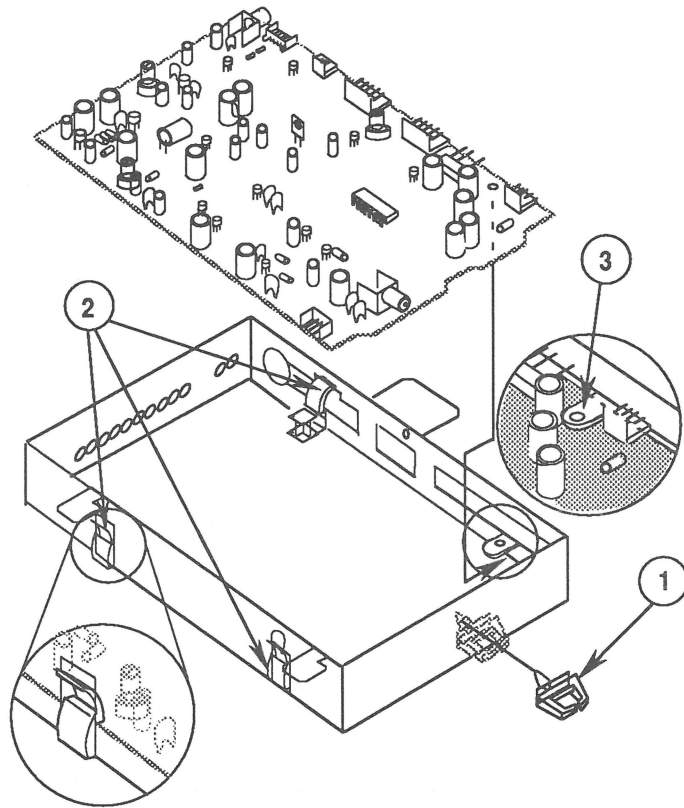


FIGURE 21

3. Replace the video board mounting screw (Figure 20, #3) through the back of the case.
4. Replace the video board case on the left chassis panel. To do this, insert the two case tabs (Figure 20, #4) into the two slots in the chassis panel, and align the mounting holes.
5. Replace the case mounting screw (Figure 20, #2).

6. Reconnect the small LED connector (Figure 22, #1) to the video board.
7. Reconnect the video cable (Figure 22, #2) to the video board, and replace the cable in the cable clamp (Figure 22, #3).

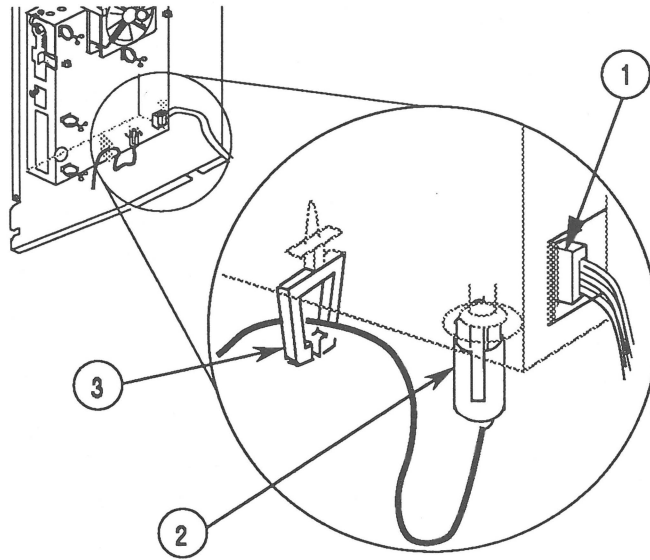


FIGURE 22

8. Reconnect these connectors to the video board:
 - **O** connector, 4-wire connector from the CRT board (Figure 23, #1)
 - **K** connector, 3-wire connector from the CRT board (Figure 23, #2)
 - **H** connector, 5-wire connector from the main deflection board (Figure 23, #3)
 - **C** connector, 6-wire connector from the contrast brightness board (Figure 23, #4)
 - **S** connector, 3-wire connector from the main deflection board (Figure 23, #5)

Replace all connector wires in the cable clamps.

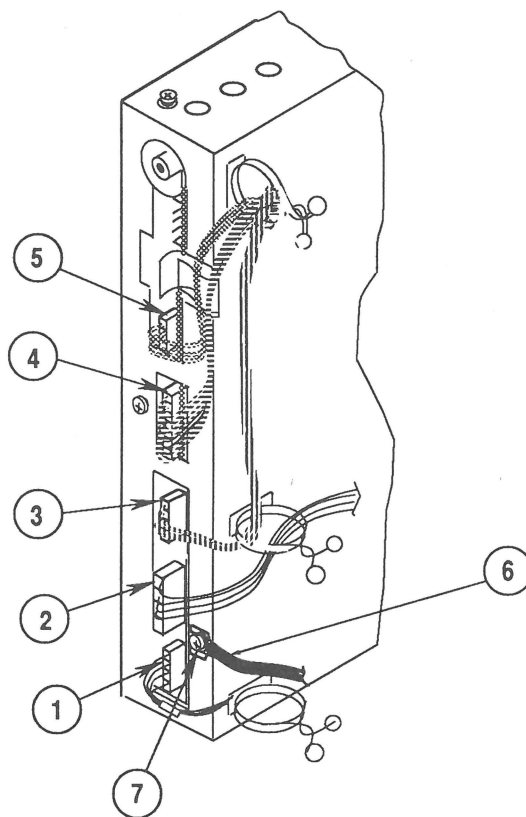


FIGURE 23

9. Replace the black ground cable (Figure 23, #6) on the video board case and tighten the screw (Figure 23, #7).
10. Replace the fan and the signal input assembly.
11. Replace the EMI shield.
12. Replace the rear cover.

❑ CONTRAST BRIGHTNESS BOARD

Materials Required

Small Phillips screwdriver

Remove

1. Remove the rear cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
5. Disconnect the **C** connector (Figure 24, #1) from the contrast brightness board (Figure 24, #2).

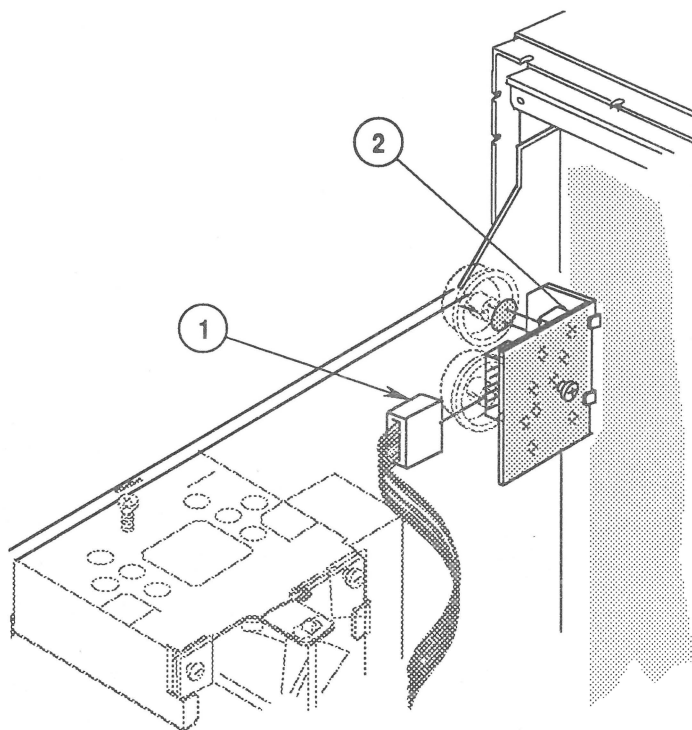


FIGURE 24

6. Remove the mounting screw (Figure 25, #1) from the contrast brightness board.
7. Pull off the two control knobs (Figure 25, #2) and remove the contrast brightness board. Keep the knobs to install them on the replacement board.

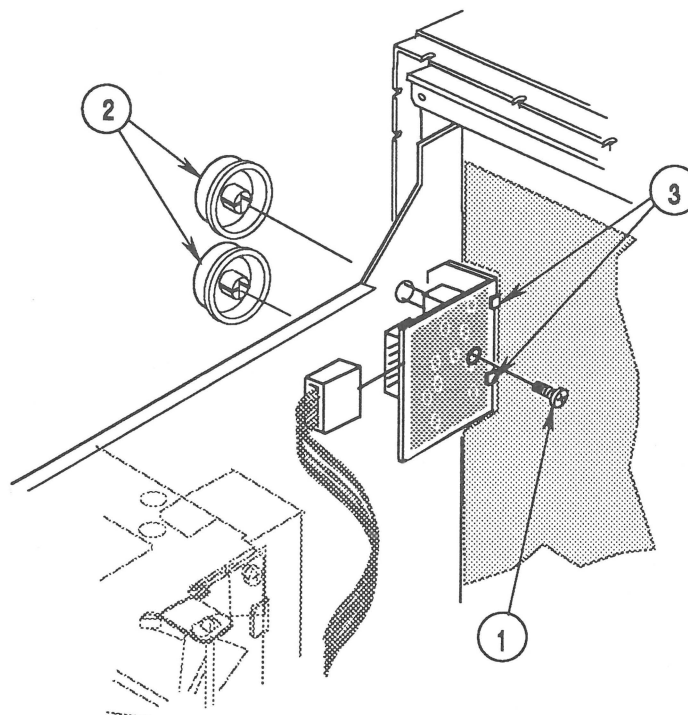


FIGURE 25

Replace

1. Reconnect the **C** connector (Figure 24, #1) to the contrast brightness board (Figure 24, #2).
2. Replace the contrast brightness board within the chassis mounting tabs (Figure 25, #3), and replace the mounting screw (Figure 25, #1).
3. Replace the two control knobs (Figure 25, #2).
4. Replace the EMI shield.
5. Replace the rear cover.

□ CRT BOARD

Materials Required

Medium Phillips screwdriver
Small needlenose pliers

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the AC input and signal input assemblies.
5. Loosen the screw (Figure 26, #1) on the video board case, and remove the black ground cable (Figure 26, #2).

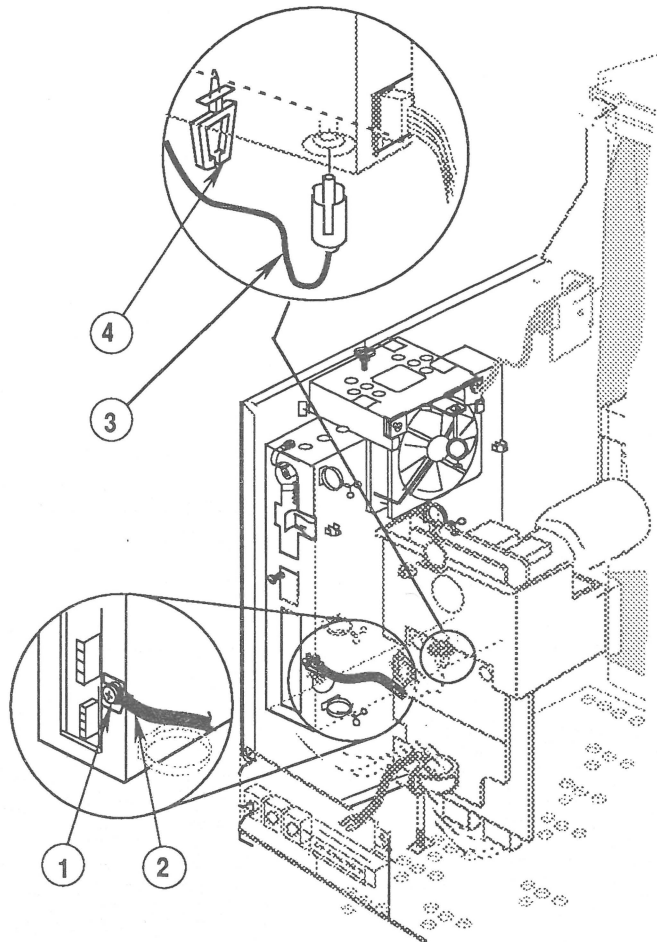


FIGURE 26

6. Remove the video cable (Figure 26, #3) from the cable clamp (Figure 26, #4) beneath the video board case, and disconnect the cable from the video board.

CAUTION: *The neck of the CRT is easily damaged. Do not apply force to the neck of the CRT when removing connectors from the CRT board.*

Note: Both side panels of the chassis are hinged and can be swung open to improve access to components.

7. Pull open the right chassis panel just enough to gain access to the upper connectors (Figure 27, #1 and #2) on the CRT board. Support the CRT board with one hand, and disconnect the following connectors:
 - 2-wire, 4-pin connector labeled **F** (Figure 27, #1)
 - 3-wire connector labeled **K** (Figure 27, #2)

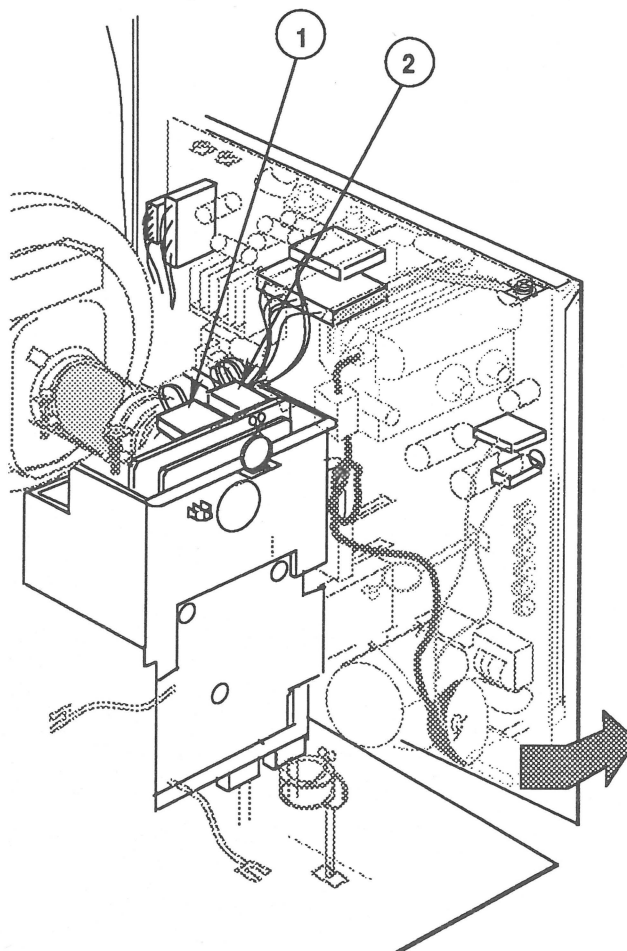


FIGURE 27

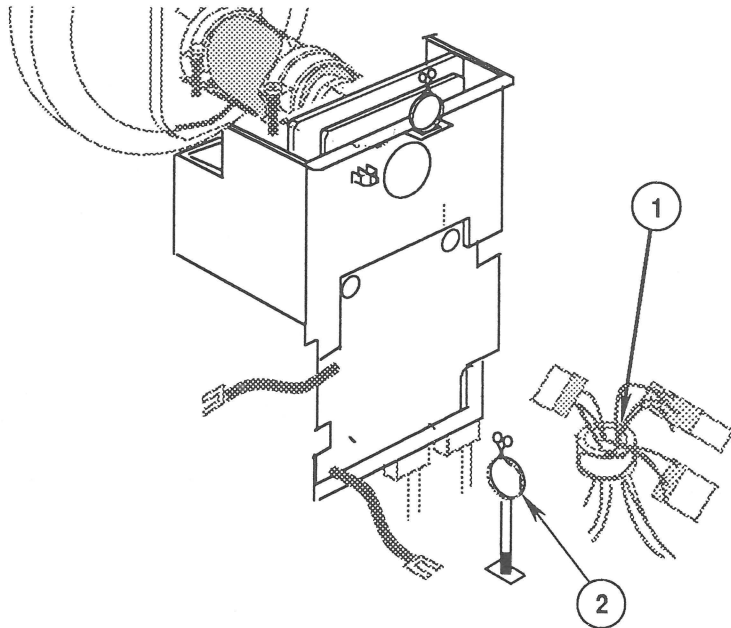


FIGURE 28

8. Remove the cables and the ferrite ring (Figure 28, #1) from the cable clamp (Figure 28, #2) that is positioned beneath the CRT board.

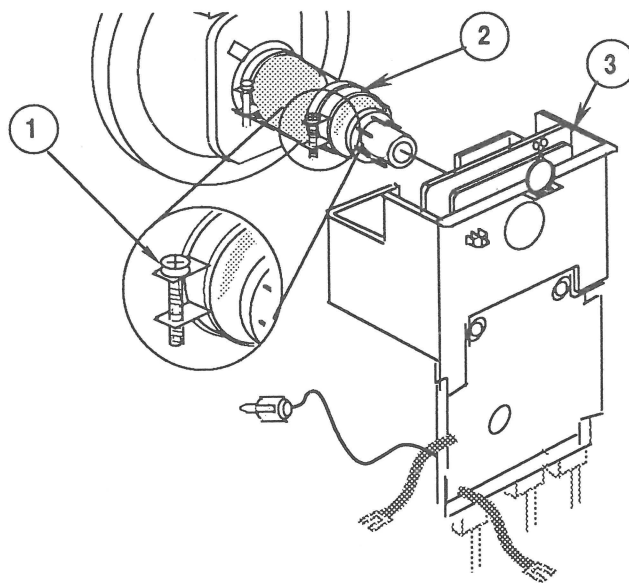


FIGURE 29

9. Loosen the screw (Figure 29, #1) on the ring clamp that secures the CRT board to the neck of the CRT (Figure 29, #2).

CAUTION: *Twisting, bending, or applying force to the CRT board could damage the neck of the CRT. Be sure to pull the CRT board straight off the neck of the CRT.*

10. Remove the CRT board from the neck of the CRT. To do this, grab with both hands the metal cover (Figure 29, #3) that protects the CRT board, and carefully pull the CRT board straight back off the CRT.

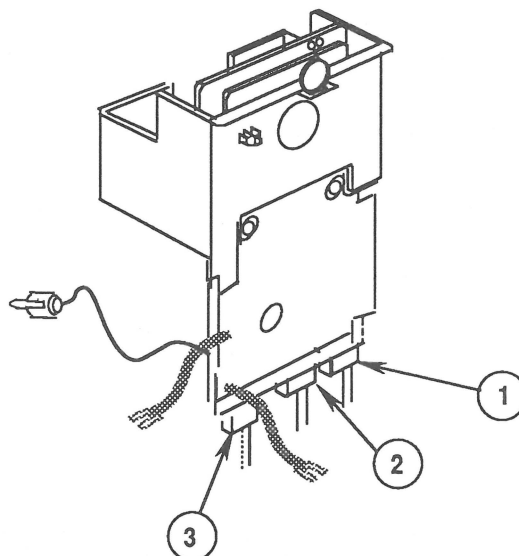


FIGURE 30

11. Disconnect the following connectors from the bottom of the CRT board:
 - 4-wire connector labeled **O** (Figure 30, #1)
 - 4-wire, 2-pin connector labeled **T** (Figure 30, #2)
 - 5-wire connector labeled **D** (Figure 30, #3)

12. Using the needlenose pliers, remove the plastic standoff (Figure 31, #1) from the bottom of the metal cover. Keep the standoff and use it to install the replacement CRT board.

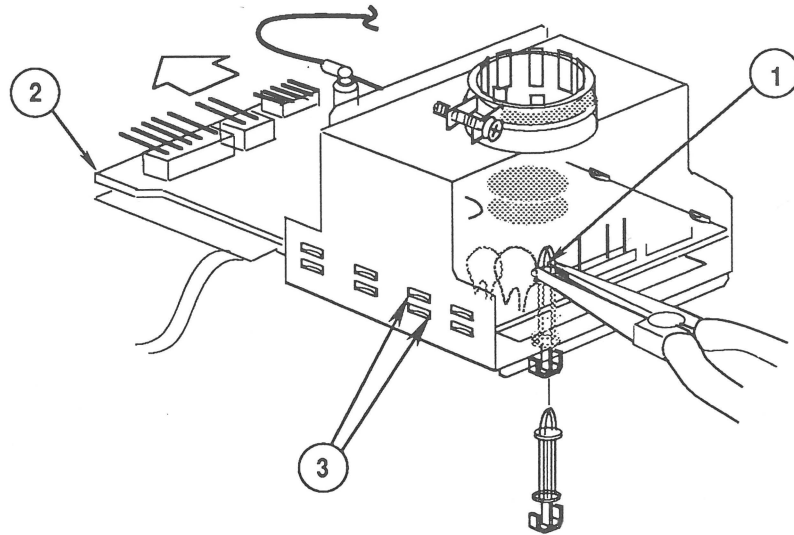


FIGURE 31

13. Slide the CRT board (Figure 31, #2) out of the metal cover. Keep the cover and install the replacement CRT board in it.

Replace

1. Slide the new CRT board (Figure 31, #2) into the metal cover as shown in Figure 31. The CRT board should be inserted between the six sets of paired tabs (Figure 31, #3) on the inside of the metal cover.
2. Replace the plastic standoff (Figure 31, #1) in the cover and CRT board.

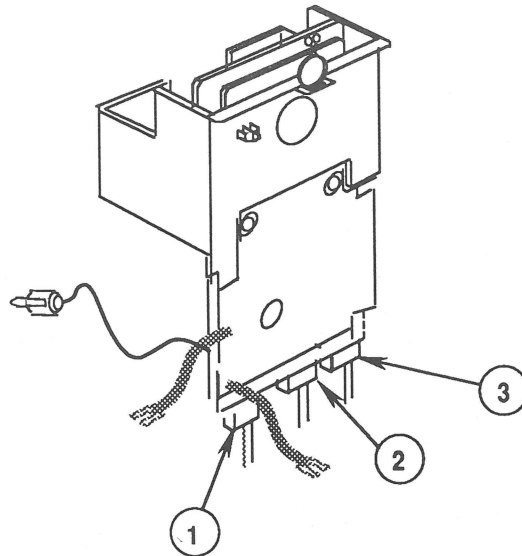


FIGURE 32

3. Reconnect the following connectors to the bottom of the CRT board:
 - **D** connector, the 5-wire connector from the main deflection board (Figure 32, #1)
 - **T** connector, the 4-wire (2-pin) connector from the main deflection board (Figure 32, #2) (this connector is not tabbed and is OK to install either way)
 - **O** connector, the 4-wire connector from the video board (Figure 32, #3)

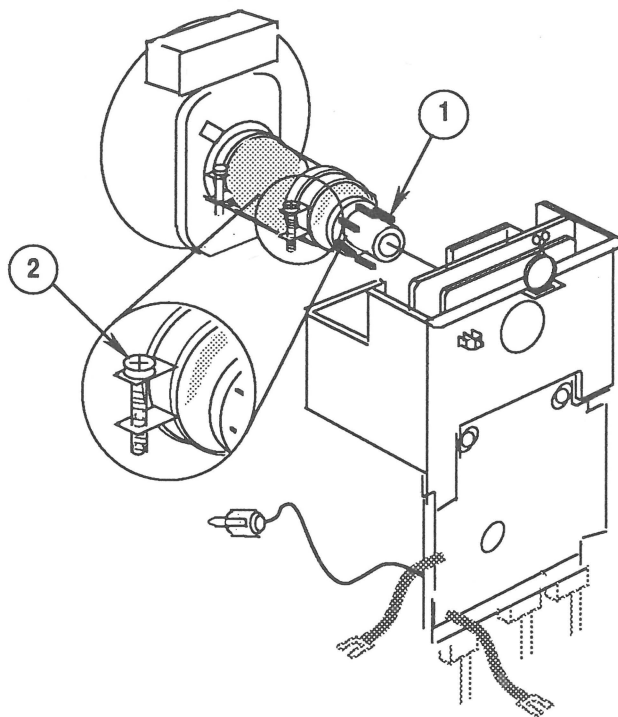


FIGURE 33

4. Replace the CRT board on the CRT. To do this, first check that none of the pins (Figure 33, #1) on the neck of the CRT is bent. Then align the CRT board connector with the CRT pins, and carefully push the board onto the CRT.

CAUTION: *The neck of the CRT is easily damaged. Do not overtighten the screw on the ring clamp.*

5. Tighten the screw (Figure 33, #2) on the ring clamp just enough to keep the CRT board from slipping.

CAUTION: The neck of the CRT is easily damaged. Do not apply force to the neck of the CRT when installing connectors on the CRT board.

6. Carefully support the CRT board with one hand, and reconnect these connectors to the top of the board:
 - **F** connector, from the main deflection board (Figure 34, #1)
 - **K** connector, from the video board (Figure 34, #2)

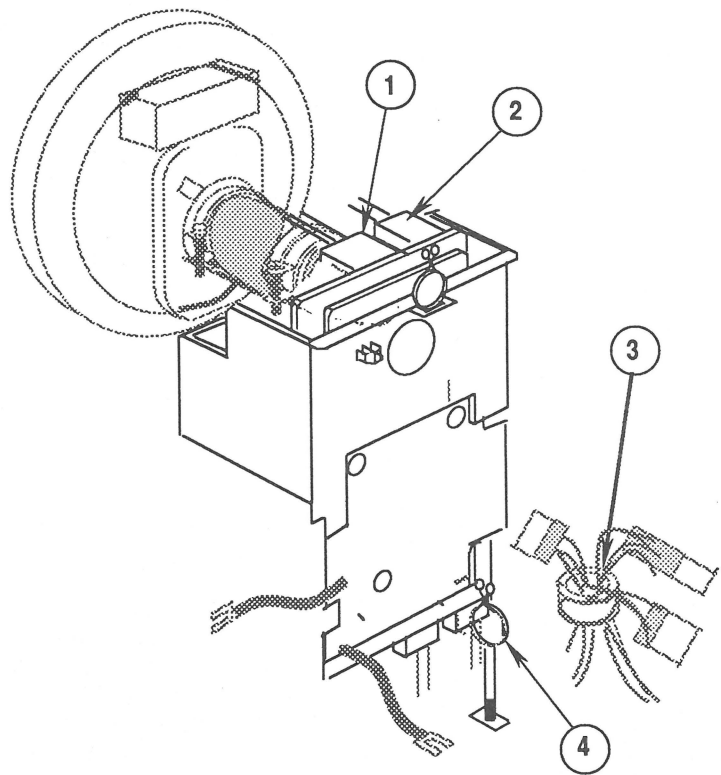


FIGURE 34

7. Replace the ferrite ring (Figure 34, #3) and the connector wires in the cable clamp (Figure 34, #4).

8. Reconnect the video cable (Figure 35, #1) to the bottom of the video board, and replace the cable in the cable clamp (Figure 35, #2).
9. Reconnect the black ground cable (Figure 35, #3) to the video board case and tighten the screw (Figure 35, #4).

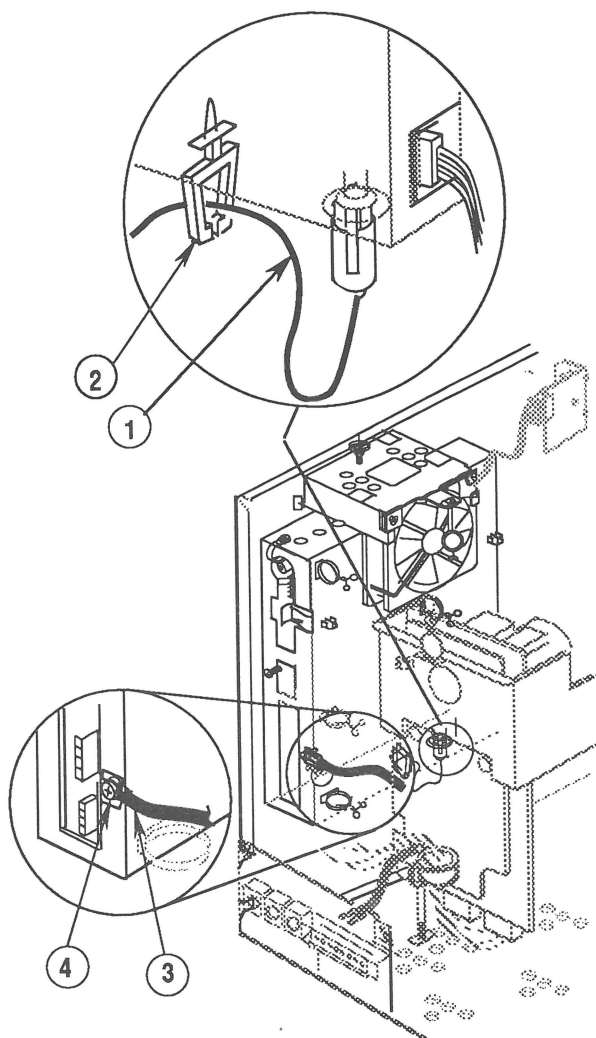


FIGURE 35

10. Replace the signal input assembly.
11. Replace the AC input assembly.
12. Replace the EMI shield.
13. Replace the rear cover.

□ MAIN DEFLECTION BOARD

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad, and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the AC input assembly.
5. Disconnect the following connectors from the main deflection board:
 - 2-wire connector labeled **T** (Figure 36, #1)
 - Single connector labeled **GB** (Figure 36, #2)

Unravel the GB connector cable from the large red anode cable.

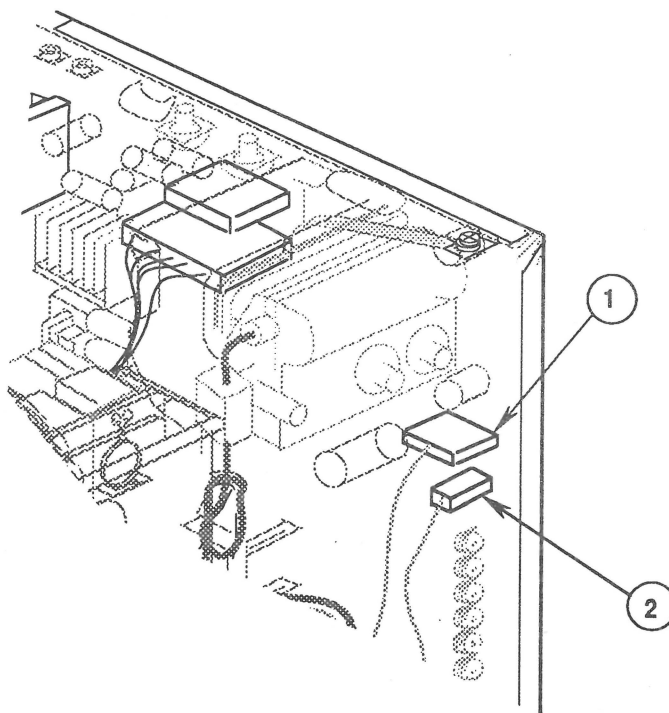


FIGURE 36

6. Disconnect the fan cable (Figure 37, #1) at the fan connectors (Figure 37, #2).

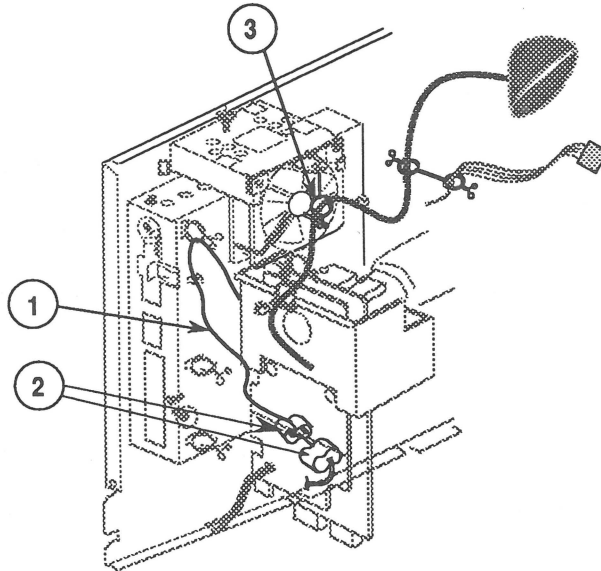


FIGURE 37

7. Remove the fan cable (Figure 37, #1) and the large red anode cable (Figure 37, #3) from the cable clamps.

Note: Both side panels of the chassis are hinged and can be swung open to improve access to components.

8. Pull open (see Figure 38) the right chassis panel.

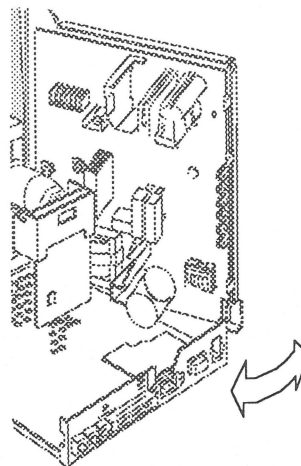


FIGURE 38

9. Disconnect the following connectors from the inside of the main deflection board:

- 8-wire connector labeled **H** (Figure 39, #1)
- 5-wire connector labeled **D** (Figure 39, #2)
- 2-wire, 3-pin connector labeled **F** (Figure 39, #3)
- 4-wire connector labeled **M** (Figure 39, #4)

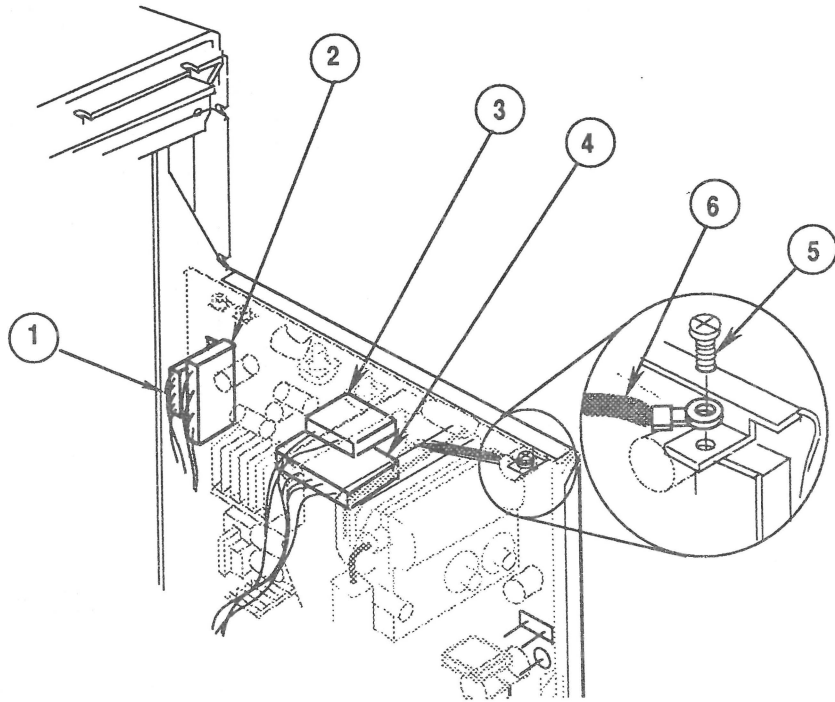


FIGURE 39

10. Remove the screw (Figure 39, #5) that secures the black ground cable (Figure 39, #6) to the top of the chassis.

11. Remove the two screws with lockwashers (Figure 40, #1) from the outside of the right chassis panel.

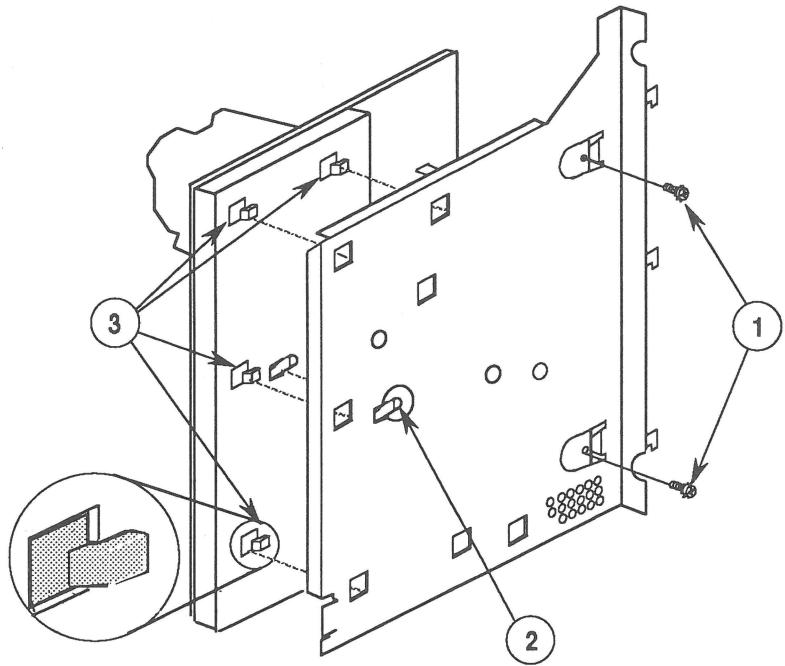


FIGURE 40

Note: The main deflection board is mounted in a plastic cover, which is mounted to the chassis. **Do not attempt to remove the main deflection board from the plastic cover.** When returning a defective main deflection board to Apple, return the board and cover as a unit.

12. Depress the plastic release latch inside the access hole (Figure 40, #2) in the chassis panel, and pull the main deflection board off the chassis.

Replace

1. Replace the main deflection board on the chassis. To do this, locate the five tabs (Figure 40, #3) at the back of the plastic cover, and hook the five tabs through five holes in the chassis panel. Then slide the panel toward the CRT to seat it on the chassis.

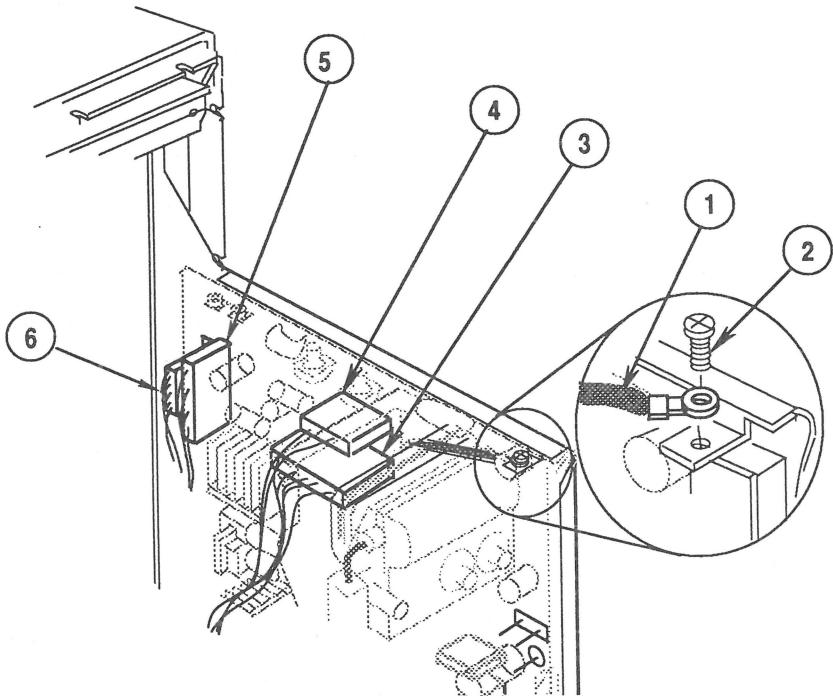


FIGURE 41

2. Replace the two mounting screws with lockwashers (Figure 40, #1).
3. Replace the black ground cable (Figure 41, #1) and screw (Figure 41, #2) on the top of the chassis.
4. Reconnect the following connectors to the inside of the main deflection board:
 - **M** connector from the CRT yoke (Figure 41, #3)
 - **F** connector from the CRT board (Figure 41, #4)
 - **D** connector from the CRT board (Figure 41, #5)
 - **H** connector (8 pins) from the video board (Figure 41, #6)

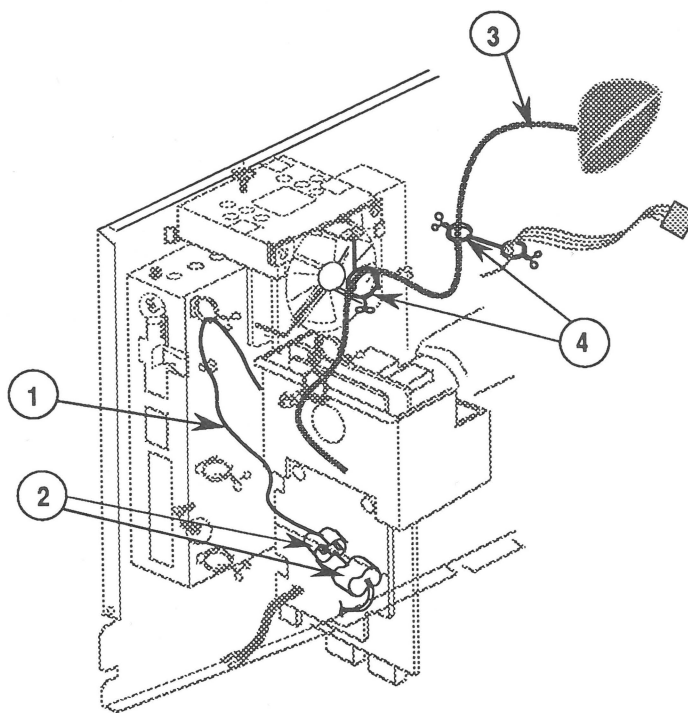


FIGURE 42

5. Reconnect the fan cable (Figure 42, #1) at the fan connectors (Figure 42, #2).
6. Swing in the right chassis panel, and replace the anode cable (Figure 42, #3) in the two cable clamps (Figure 42, #4).

Note: Before connecting the **GB** connector to the main deflection board, take up excess wire by wrapping the **GB** cable (from the CRT) around the large red anode cable.

7. Reconnect the following connectors to the main deflection board:
 - **GB** connector from the CRT (Figure 43, #1)
 - **T** connector from the CRT board (Figure 43, #2) (this connector is not tabbed and is OK to install either way)

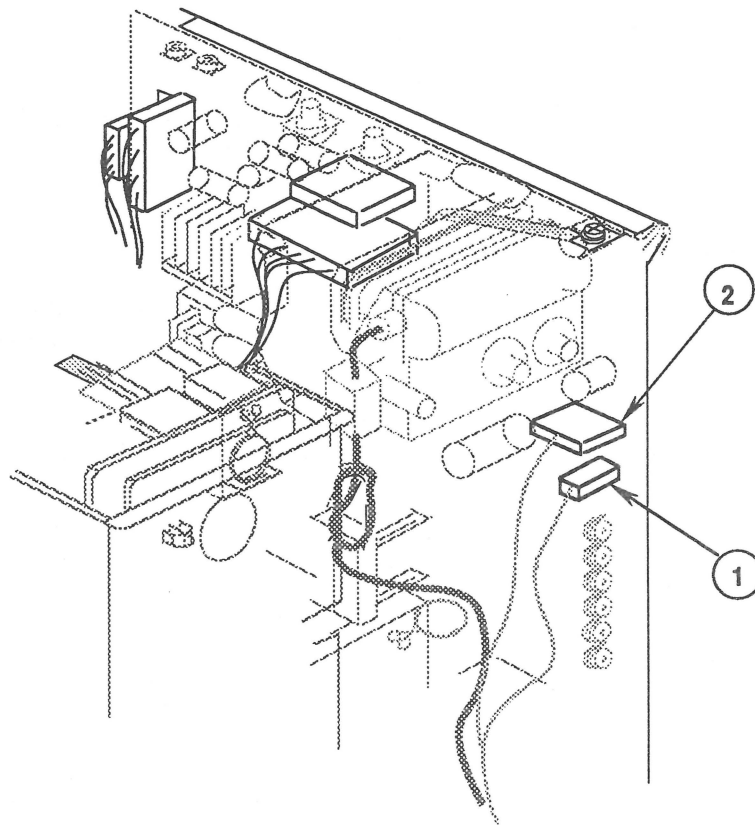


FIGURE 43

8. Replace the AC input assembly.
9. Replace the anode cap (refer to "Discharging the Cathode-Ray Tube").
10. Replace the EMI shield.
11. Replace the rear cover.

□ BEZEL

Materials Required

Small Phillips screwdriver (magnetic)

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Carefully set the monitor face down on a soft, protective surface.
5. Remove the four screws (Figure 44, #1) that secure the bezel (Figure 44, #2) to the chassis.

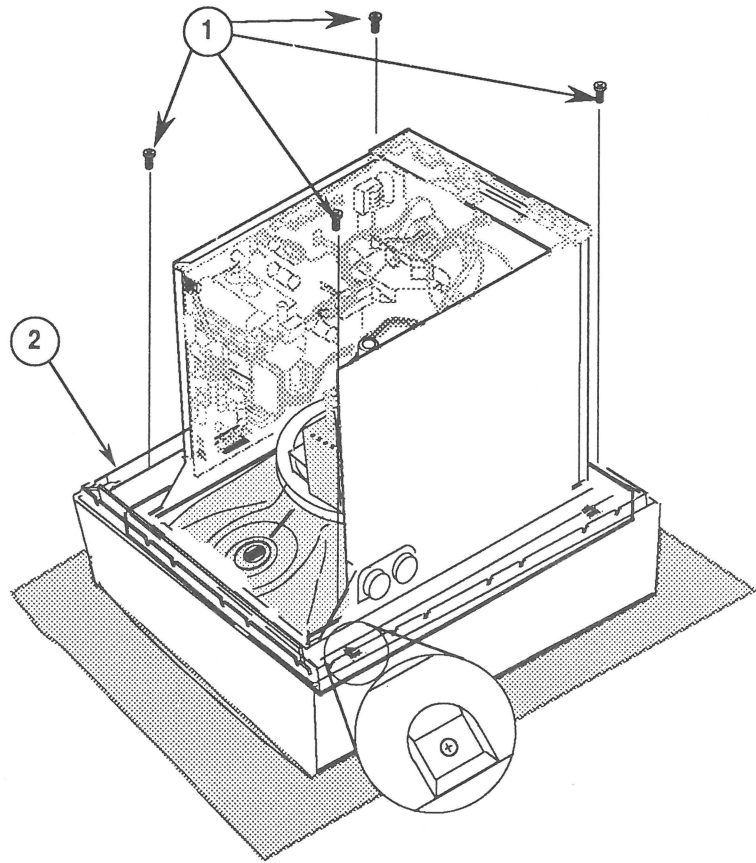


FIGURE 44

6. Set the monitor upright on the protective surface.
7. Slightly lift the chassis, and pull off the bezel (Figure 45, #1). It is easiest to pull off the top of the bezel first.

Replace

1. Slightly lift the monitor chassis, and slide the bezel (Figure 45, #1) over the chassis. It is easiest to slide the top of the bezel onto the chassis, and then slide on the bottom.
2. Carefully set the monitor face down on a soft, protective surface. Make sure the front of the chassis slides all the way inside the bezel at top, sides, and bottom.

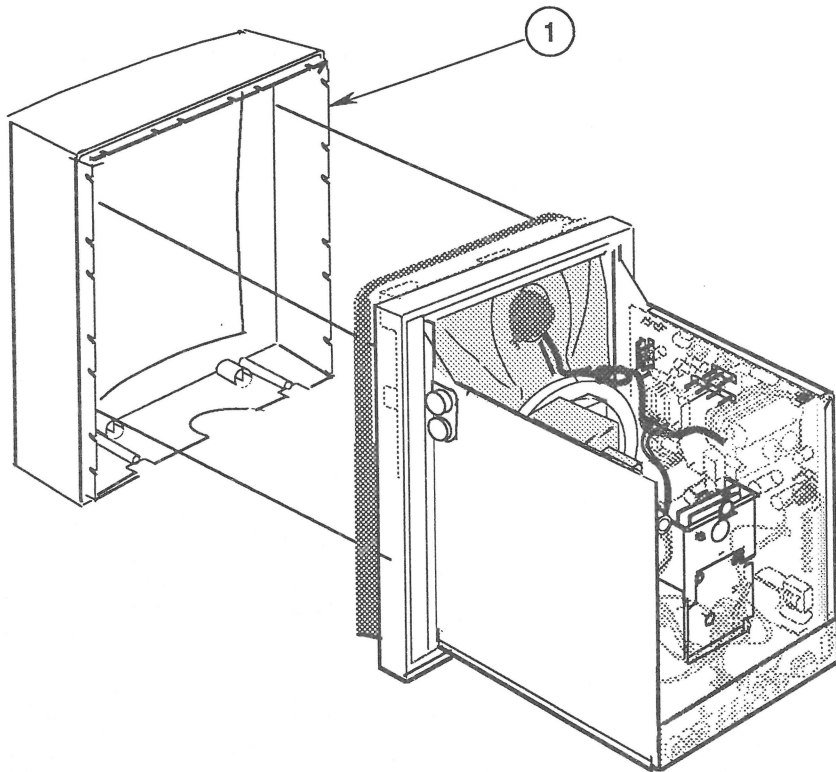


FIGURE 45

3. Replace the four bezel mounting screws (Figure 44, #1).
4. Replace the EMI shield and the rear cover.

□ LED CABLE ASSEMBLY

Materials Required

Medium Phillips screwdriver
Tie-wrap

Remove

1. Remove the rear cover.
2. Remove the EMI shield.
3. Discharge the CRT.
4. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
5. Remove the bezel.
6. Disconnect the small LED connector (Figure 46, #1) from the bottom of the video board.

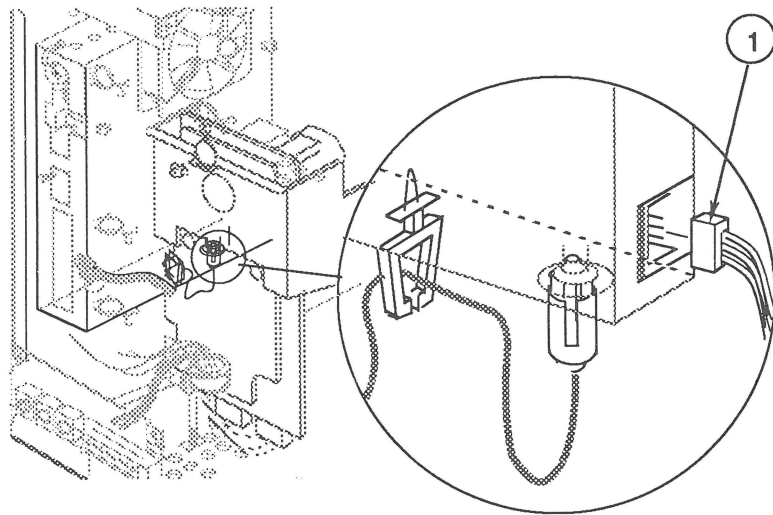


FIGURE 46

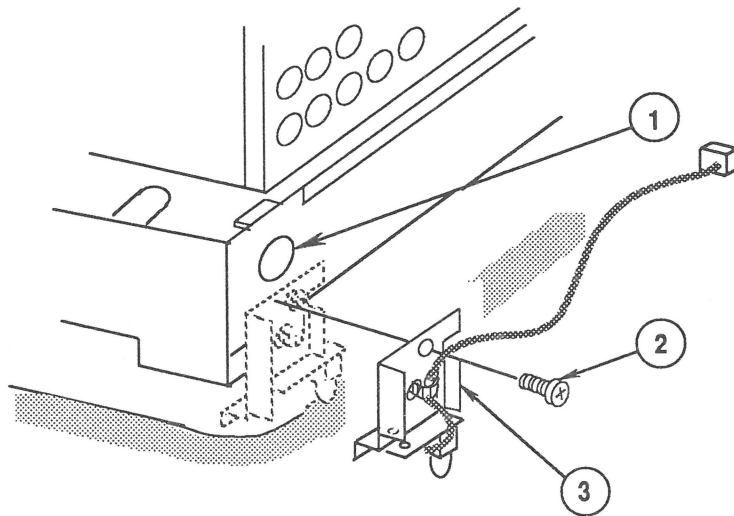


FIGURE 47

7. Carefully set the monitor face down on a soft, protective surface. The bottom panel of the chassis should be facing you.
8. Pull the small LED cable connector out of the chassis access hole (Figure 47, #1).
9. Remove the screw (Figure 47, #2) that secures the LED mounting bracket (Figure 47, #3) to the chassis.

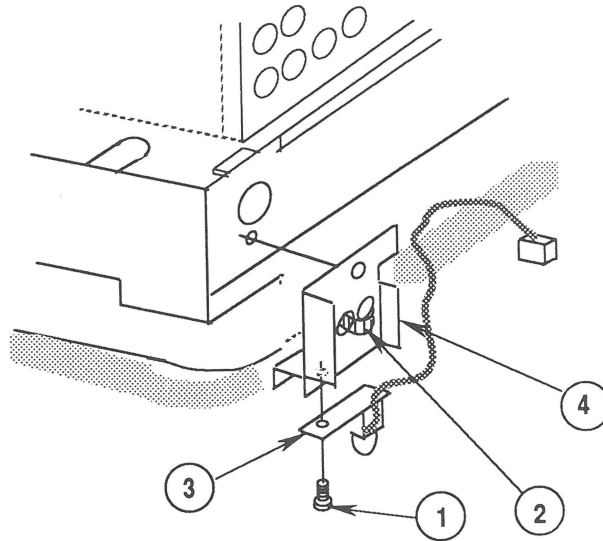


FIGURE 48

10. Remove the screw (Figure 48, #1) from the LED board.
11. Cut the tie-wrap (Figure 48, #2), and remove the LED cable assembly (Figure 48, #3) from the mounting bracket (Figure 48, #4).

Replace

1. Position the new LED cable assembly (Figure 48, #3) on the mounting bracket (Figure 48, #4), and replace the mounting screw (Figure 48, #1).
2. Install a new tie-wrap (Figure 48, #2) around the LED cable and mounting bracket as shown in Figure 48.

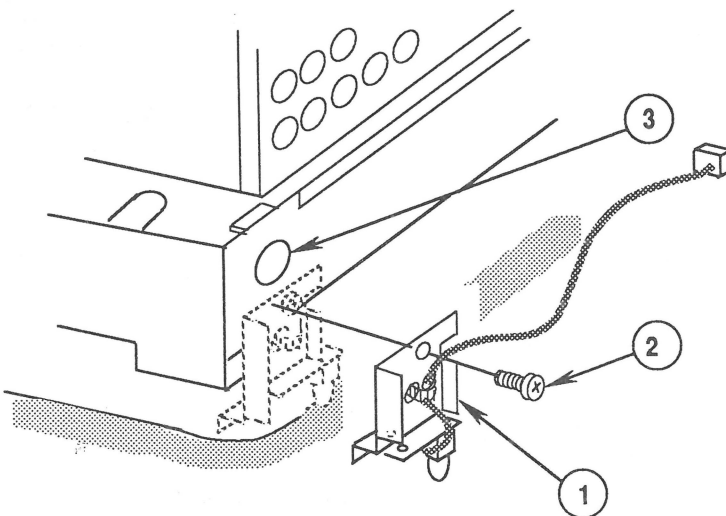


FIGURE 49

3. Carefully set the monitor face down on a soft, protective surface. The bottom panel of the chassis should be facing you.
4. Align the LED mounting bracket (Figure 49, #1) on the chassis, and install the mounting screw (Figure 49, #2).
5. Insert the LED connector through the access hole (Figure 49, #3) in the bottom of the chassis.

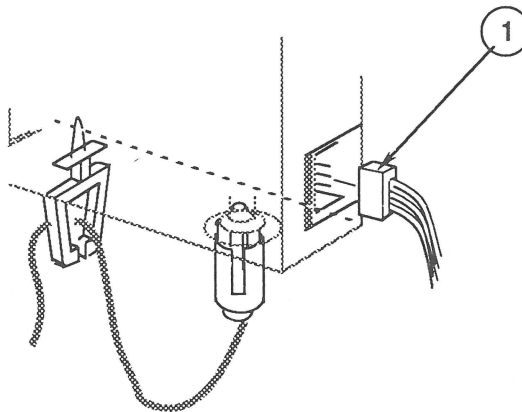


FIGURE 50

6. Set the monitor upright, and reconnect the LED connector (Figure 50, #1) to the bottom of the video board.
7. Replace the bezel.
8. Replace the EMI shield and the rear cover.

❑ CATHODE-RAY TUBE (CRT)

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover and the EMI shield.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the AC input and signal input assemblies.
5. Remove the CRT board.
6. Disconnect the following connectors from the main deflection board:
 - 4-wire, CRT connector **M** (Figure 51, #1)
 - Single-wire connector **GB** (Figure 51, #2)

Remove the CRT cable from the cable clamp (Figure 51, #3) at the bottom of the chassis, and unwrap the **GB** cable from the anode cable.

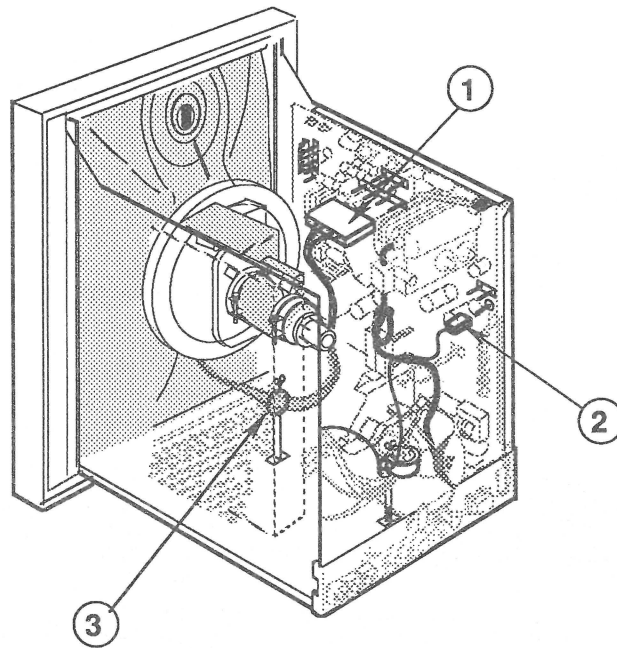


FIGURE 51

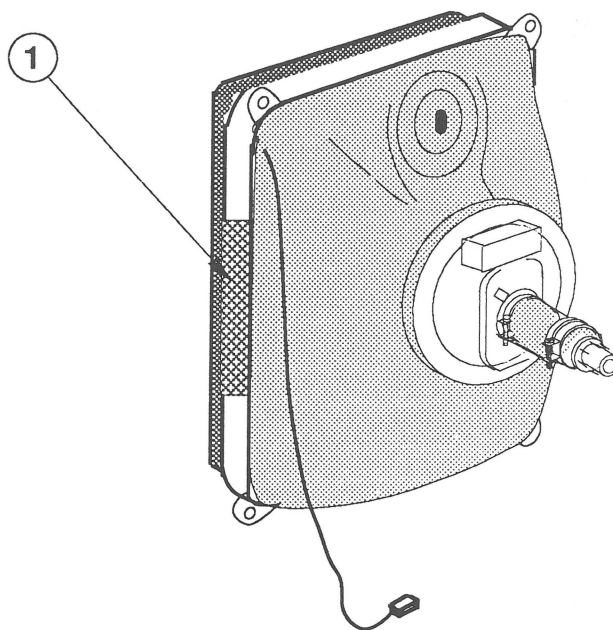


FIGURE 52

7. Remove the bezel.
8. Remove the LED mounting bracket from the chassis. (Refer to "LED Cable Assembly.")
9. Set the monitor upright. Remove and discard the copper tape (Figure 52, #1) from both sides of the CRT and chassis. (Two new strips of copper tape are provided with the replacement CRT).
10. Remove four mounting screws (Figure 53, #1) from the CRT.
11. Carefully grasp the sides of the CRT (not the neck), and lift the CRT out of the front of the chassis.

WARNING: If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in You Oughta Know.

Replace

1. Carefully insert the CRT through the front of the chassis. Make sure the CRT connector cables are also inserted through the chassis.
2. Replace but do not tighten the four mounting screws (Figure 53, #1). Push up on the CRT so that the top of the CRT is flush against the metal stop at the top of the chassis, and tighten the four screws.
3. Install new copper tape (Figure 52, #1) on both sides of the CRT. Make sure the copper tape covers the metal tab protruding from one side of the chassis.

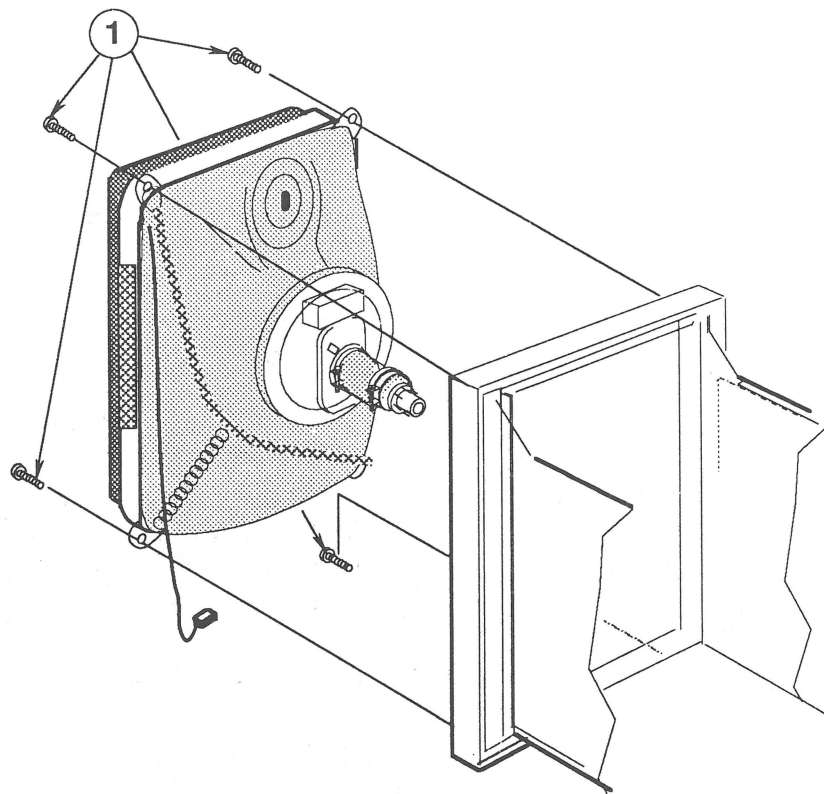


FIGURE 53

4. Replace the LED cable assembly and the bezel.

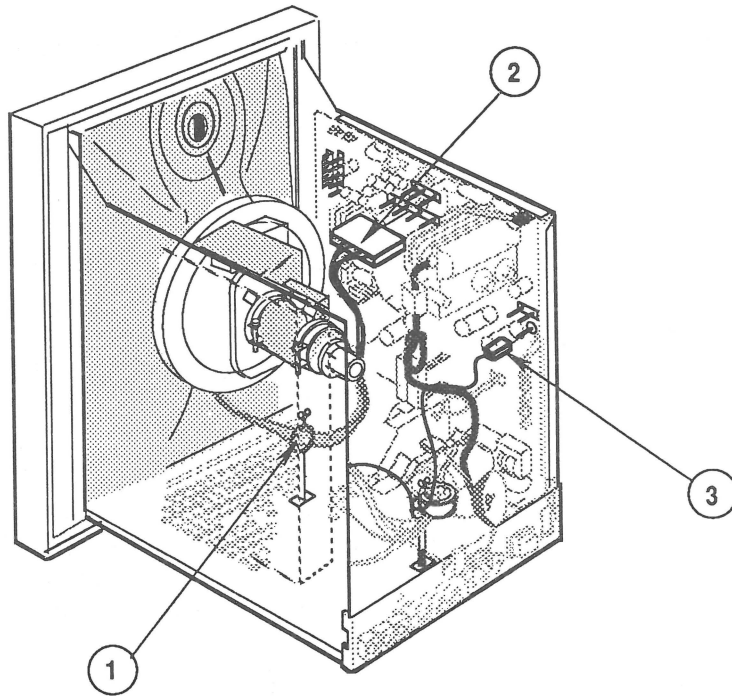


FIGURE 54

5. Replace the **M** cable (from the CRT yoke) in the cable clamp (Figure 54, #1) at the bottom of the chassis.
6. Reconnect the following connectors to the main deflection board:
 - Connector **M** (Figure 54, #2)
 - Connector **GB** (Figure 54, #3)

Note: The **GB** cable should be wrapped around the large red anode cable before connecting it to the main deflection board.

7. Replace the CRT board.
8. Replace the anode cap (refer to "Discharging the Cathode-Ray Tube").
9. Replace the signal input and AC input assemblies.
10. Replace the EMI shield and the rear cover.

Apple Macintosh Portrait Display

Section 3 – Adjustments

□ CONTENTS

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3.3	Safety Instructions
3.4	Live Adjustment Rules
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3.26	MacTest IIcx/IIci Test Patterns
3.26	Materials Required
3.26	Generating the Test Patterns

□ INTRODUCTION

Whenever you replace a module within the Apple Macintosh Portrait Display, some adjustment of the video display may be necessary. As a general rule, replacing the main deflection board may require making geometric (vertical/horizontal) or focus adjustments, whereas replacing the CRT or video board requires performing the video adjustments. For more information about inspecting the Macintosh Portrait Display, refer to "Monitor Inspection" in Section 4, Troubleshooting.

IMPORTANT: *Do not attempt any tilt or ring adjustments on the Macintosh Portrait Display. All such yoke adjustments have been set by the manufacturer.*

Use the following procedures to perform horizontal, vertical, focus, and video adjustments. If these procedures do not correct the monitor's adjustment problems, isolate the faulty module (see Section 4, Troubleshooting) and return it to Apple.

□ SAFETY INSTRUCTIONS

WARNING: *The Macintosh Portrait Display contains a high-vacuum picture tube and operates at very high voltages. To prevent serious injury, learn all safety precautions in Section 1, Basics, before you proceed!*

In addition to following all safety precautions in the Basics section, be sure to:

- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with your other hand.
- Use a mirror for viewing adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to the back of the monitor to rotate the controls—you cannot see what you are about to touch!
- Perform only those adjustments that are absolutely necessary. Do not attempt to make any adjustments other than the ones explained in this section, and do those with extreme caution.

WARNING: Serious injury could result if, with the power on, you touch any of the components shown in Figure 1.

**Live
Adjustment
Rules**

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Macintosh Portrait Display:

- Any part of the yoke assembly, including the yoke wires (Figure 1, #1)
- The anode wire (Figure 1, #2)
- The anode connector (Figure 1, #3)
- The flyback transformer (Figure 1, #4)
- The inside of the AC power switch (Figure 1, #5)

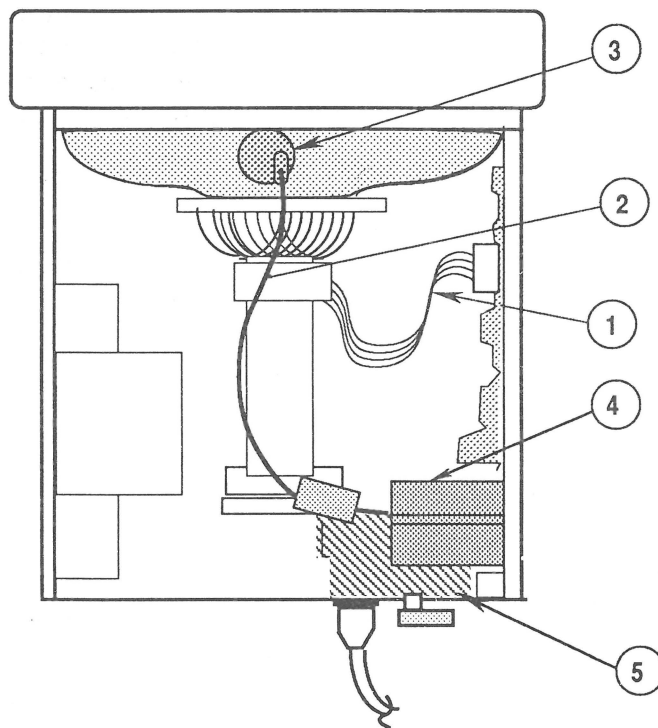


FIGURE 1

□ LOCATION OF CONTROLS

User Controls

The BRIGHTNESS control (Figure 2, #1) and the CONTRAST control (Figure 2, #2) are located on the side of the monitor's case and are accessible to the user.

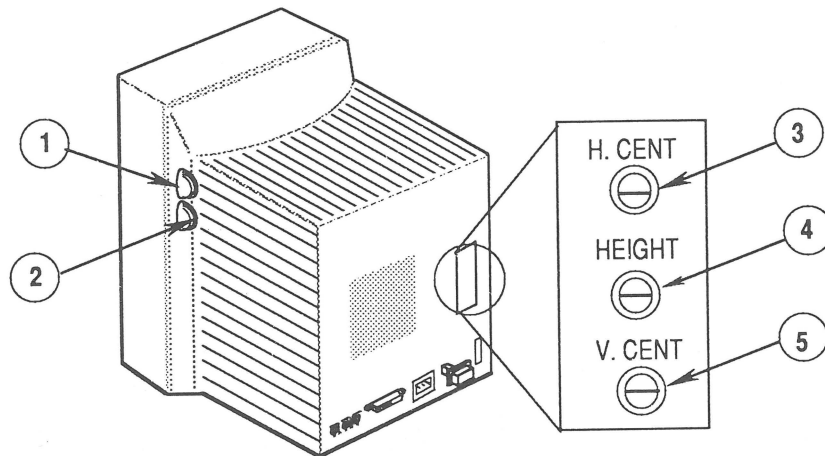


FIGURE 2

External Service Controls

The following service adjustment controls are located on the main deflection board, but can be accessed by removing a plastic panel found on the rear cover:

- HORIZONTAL CENTER (Figure 2, #3)
- HEIGHT (Figure 2, #4)
- VERTICAL CENTER (Figure 2, #5)

Internal Service Controls

The internal service adjustment controls are located on the video board, the CRT board, and the main deflection board. These controls can be accessed only after removing the rear cover.

Video board:

- BIAS (Figure 3, #1)
- GAIN (Figure 3, #2)
- SUBBRIGHT (Figure 3, #3)

CRT board:

CUTOFF (Figure 3, #4)

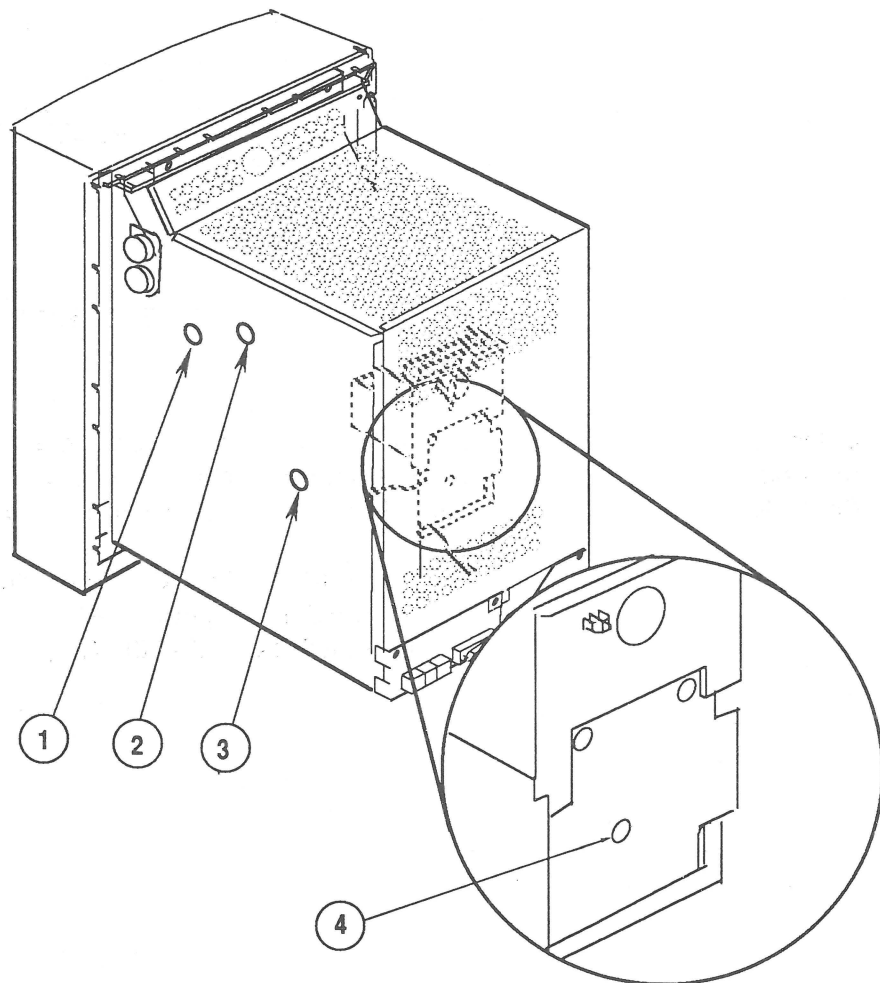


FIGURE 3

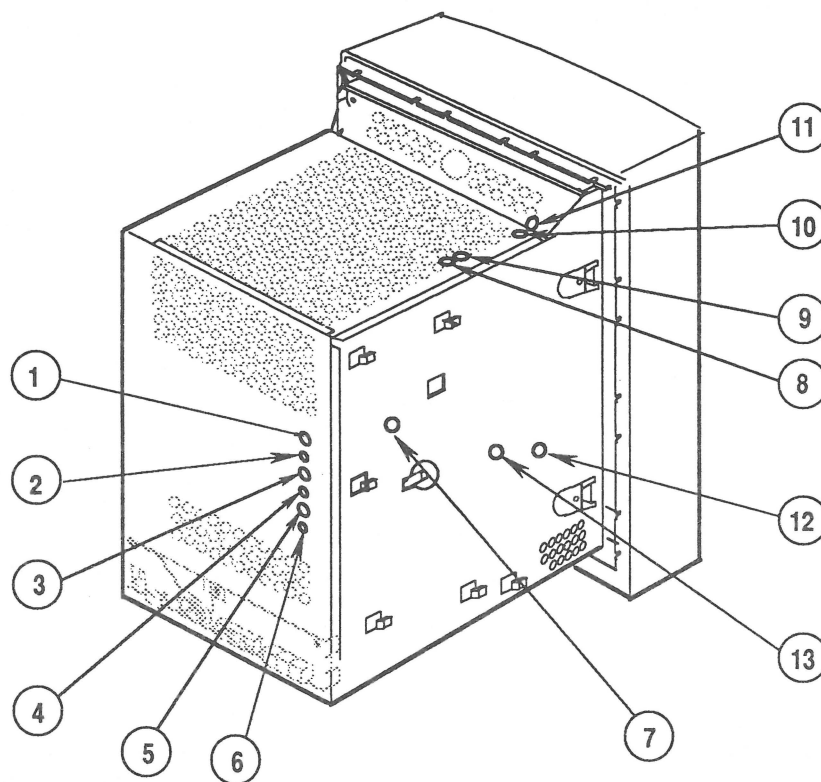


FIGURE 4

Main deflection board:

Back:

- H.CENT (Figure 4, #1)
- H.PHASE (Figure 4, #2)
- HEIGHT (Figure 4, #3)
- V.LIN (Figure 4, #4)
- V.CENT (Figure 4, #5)
- SIDE.PIN (Figure 4, #6)

Side:

- H.SIZE (Figure 4, #7)
- SCREEN (Figure 4, #8)
- FOCUS (Figure 4, #9)
- V.FOCUS (Figure 4, #10)
- H.FOCUS (Figure 4, #11)
- H.HOLD (Figure 4, #12)
- V.HOLD (Figure 4, #13)

Note: The H.HOLD and V.HOLD controls (Figure 4, #12 and #13) are preset at the factory and do not need readjusting.

□ MACTEST II/IIxTEST PATTERNS

Use the following procedure to display test patterns on a Portrait Display that is connected to a Macintosh II or Macintosh IIx computer. Refer to "MacTest IIcx/IIci Test Patterns" later in this section to display test patterns using a Macintosh IIcx or Macintosh IIci and the *MacTest IIcx/IIci* diagnostic.


Materials Required

Macintosh II or Macintosh IIx
Macintosh II Portrait Video Card
MacTest™ II/IIx diagnostic disk (version 3.1 or higher)

IMPORTANT: *The Macintosh II Portrait Video Card RAM must be upgraded to 512K in order to display the MacTest II/IIx test patterns. Refer to the Macintosh Family Cards Technical Procedures.*

Generating the Test Patterns

MacTest II/IIx tests the video RAM on the Macintosh II Portrait Video Card, and displays test patterns used to adjust the monitor. Follow the steps below to display the *MacTest II/IIx* test patterns:

1. Connect the monitor's video cable and power cord to the Macintosh II or Macintosh IIx computer.
2. Boot the *MacTest II/IIx* disk. For computers with more than one drive, boot *MacTest* from Drive 1, the right-side drive.
3. *MacTest II/IIx* will display a window instructing you to turn off the system and connect a SCSI loopback card. Unless you wish to test the logic board, click **OK** to get to the Start window.
4. When the Start window appears on the screen, go to the  menu and open the Control Panel.
5. Click the Monitors icon.
6. In the area called **Characteristics of selected monitor**, select **Black & White/Grays**. In the area called **Grays**, select **16**.

7. If more than one monitor is connected to the computer, make sure the Macintosh Portrait Display is the main monitor. (Test patterns can be displayed on the main monitor only.) Check the box at the bottom of the panel—the monitor icon with a menu bar is the main monitor. If necessary, drag the menu bar to the icon representing the Portrait Display.

8. Close the Control Panel to return to the Start window.

Note: If you selected a new main monitor, you must restart *MacTest II/Ix* in order for this change to take effect. After closing the Control Panel, quit *MacTest II/Ix* and then reboot *MacTest II/Ix*.

9. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect the default Logic and Disk Drives tests by clicking their selection boxes once.
10. To test video RAM on the video card, click **Video Card in slot**. Apple recommends testing the video card before performing the video adjustments.
11. Click **Video monitor** to display the video adjustment test patterns, and click **OK** to close the Test Selections window.
12. When the Start window reappears, click **Start**.

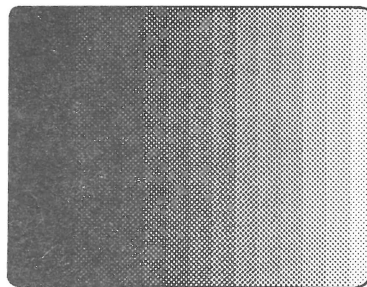
Note: If you selected the video card RAM test, this message will appear: **Testing Macintosh Video Card**. Horizontal and vertical lines will flash across the screen. After about one minute the Start window will reappear, and the Status line will indicate whether the video card has passed the test.

13. An alert box appears to inform you that test patterns can be displayed only on the default monitor. Click **OK** to display the first test pattern.

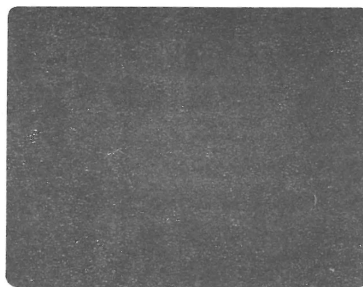
Note: Click the mouse to advance to the test pattern you want. Each test pattern is displayed once. When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in slot** in the Test Selections window.)

14. *MacTest II/Ix* displays the test patterns listed below and shown in Figure 5.

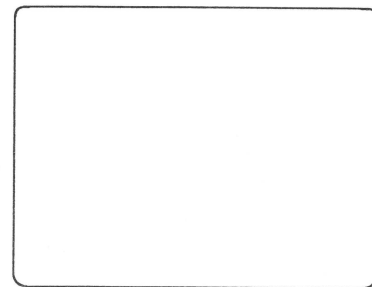
- Gray Bars
- Full Black Screen
- Full White Screen
- Crosshatch I (black background)
- Crosshatch II (white background)
- Focus



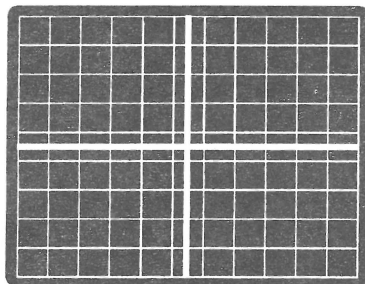
Gray Bars



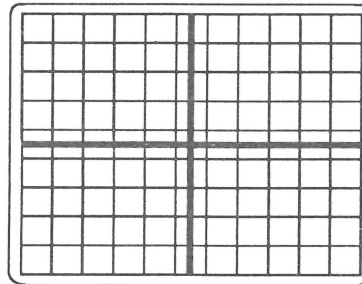
Full Black Screen



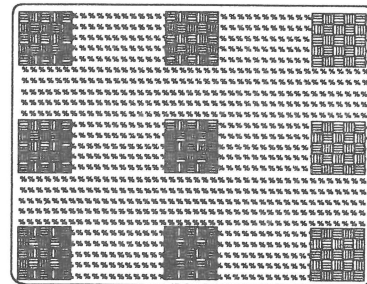
Full White Screen



Cross Hatch I
(Black Background)



Cross Hatch II
(White Background)



Focus

FIGURE 5

□ ADJUSTMENT PROCEDURES

All service adjustments are performed with the rear cover removed. The video adjustments require that the rear panel of the EMI shield also be removed (see Section 2, Take-Apart).

Materials Required

Plastic adjustment tool (insulated screwdriver)
Plastic hex alignment tool
Voltmeter
Light meter (Sekonic Multi-Lumi, model L-248)
Mirror
Flexible metric ruler

Horizontal Adjustments

The horizontal adjustments use the **Full White Screen** test pattern. To display this pattern, see "Test Patterns."

Adjusting Horizontal Size

Using the hex alignment tool, turn the horizontal size (H.SIZE) control (Figure 6, #1) until the raster is 203 mm wide.

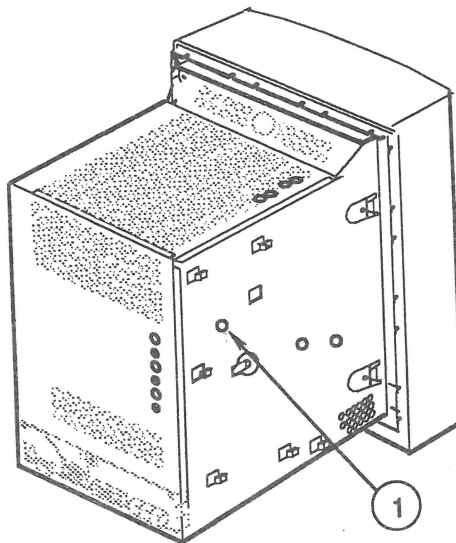


FIGURE 6

Note: To measure the raster width, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the left edge of the

...Continued on next page

raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the right edge of the raster, and note the ruler measurement. Adjust the H.SIZE control as necessary.

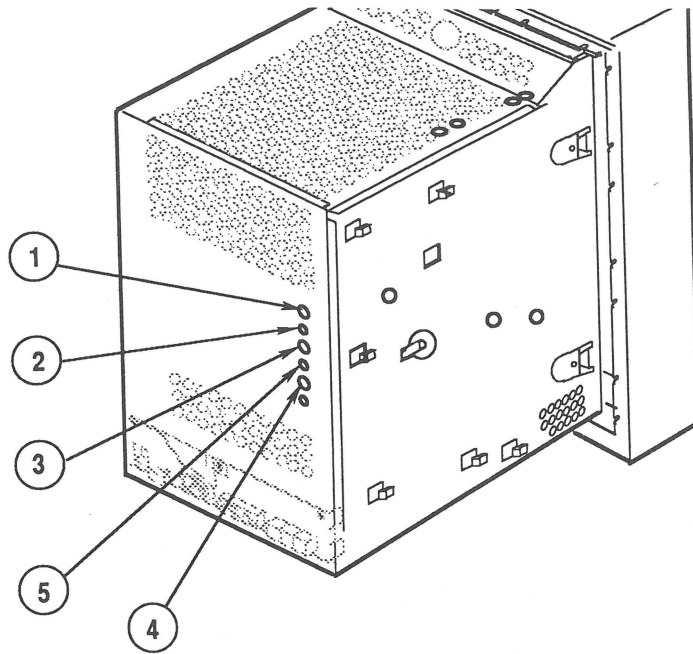


FIGURE 7

Adjusting Horizontal Center

1. Using the insulated screwdriver, turn the horizontal center (H.CENT) control (Figure 7, #1) until the raster is centered (left to right) in the display area.
2. Verify that the raster is 203 mm wide. If it is not, perform the horizontal size adjustment and repeat (if necessary) the horizontal center adjustment.

Adjusting Horizontal Phase

Measure the black margin on the right side of the display. The black margin should measure 7 to 8 mm from the right edge of the white raster to the edge of the plastic bezel. If necessary, use the insulated screwdriver to turn the horizontal phase (H.PHASE) control (Figure 7, #2) until the black margin is 7 to 8 mm wide.

Vertical Adjustments

The vertical size and vertical center adjustments use the **Full White Screen** test pattern; the vertical linearity adjustment uses a **Crosshatch** test pattern. To display these patterns, see "Test Patterns."

Adjusting Vertical Size

1. Display the **Full White Screen** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the vertical size (HEIGHT) control (Figure 7, #3) until the raster is 276 mm high.

Note: To measure the raster height, place a flexible metric ruler against the screen, and align the zero mark of the ruler exactly over the top edge of the raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the bottom of the raster, and note the ruler measurement. Adjust the HEIGHT control as necessary.

Adjusting Vertical Center

1. Display the **Full White Screen** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the vertical center (V.CENT) control (Figure 7, #4) until the raster is centered (top to bottom) in the display area.
3. Verify that the raster is 276 mm high. If it is not, perform the vertical size adjustment and (if necessary) repeat the vertical center adjustment.

Adjusting Vertical Linearity

1. Display either **Crosshatch** test pattern on the monitor (see "Test Patterns").
2. Using the insulated screwdriver, turn the vertical linearity (V.LIN) control (Figure 7, #5) until the boxes at the top of the display are the same size as those at the bottom.

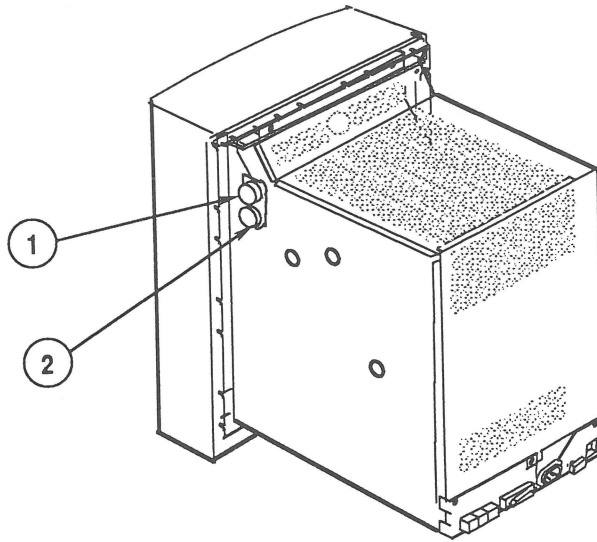


FIGURE 8

Focus

1. Display the **Focus** test pattern on the monitor (see "Test Patterns").
2. Set the BRIGHTNESS control (Figure 8, #1) to midrange—the detent position. To identify the detent position, turn the knob and locate the place in the middle where the knob hesitates.
3. Set the CONTRAST control (Figure 8, #2) at maximum (full clockwise).
4. Using the insulated screwdriver, turn the SCREEN control (Figure 9, #1) to its full counterclockwise position. This increases the brightness of the display.
5. Successively adjust the three focus controls:
 - a) Turn the static focus (FOCUS) control (Figure 9, #2) to attain the best possible overall focus.
 - b) Turn the horizontal focus (H.F.) control (Figure 9, #3) to attain the best possible focus along the left and right edges of the display.
 - c) Turn the vertical focus (V.F.) control (Figure 9, #4) to attain the best possible focus at the top and bottom of the display.
 - d) Repeat substeps a to c until you have attained the best focus possible.

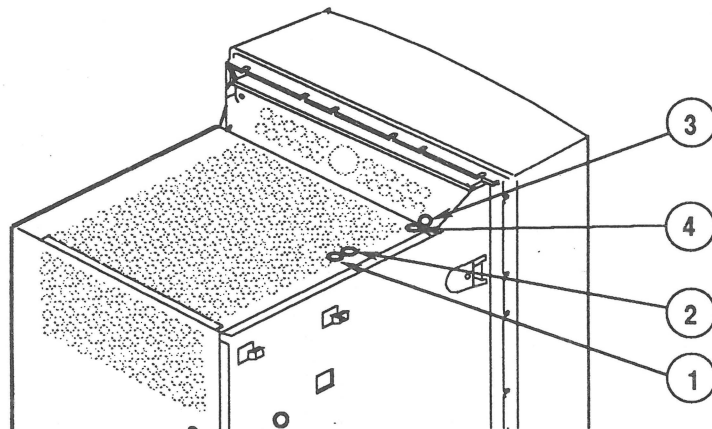


FIGURE 9

Video Adjustments

The video adjustments should be performed whenever the CRT or video board has been replaced. Before beginning the video adjustments, be sure to remove the rear panel of the EMI shield (see Section 2, Take-Apart).

CAUTION: *With the rear panel of the EMI shield removed, the signal input board assembly is loose and could short to chassis ground. To prevent damaging the monitor, reinstall the three mounting screws (Figure 10, #1) in the metal brackets and chassis.*

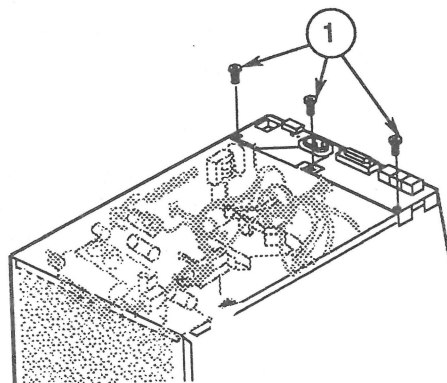


FIGURE 10

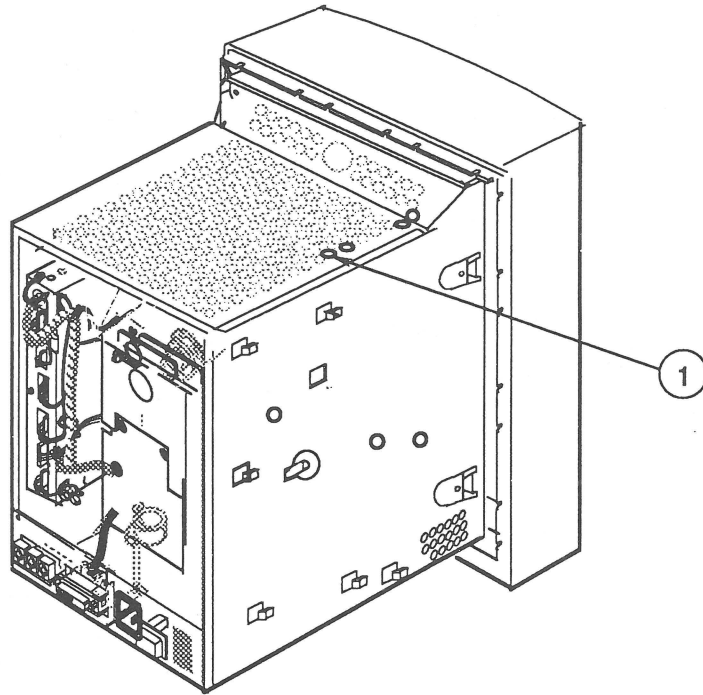


FIGURE 11

1. Display the **Gray Bars** test pattern on the monitor (see "Test Patterns").
2. Make sure the SCREEN control (Figure 11, #1) is at maximum (full counterclockwise). If not, use the insulated screwdriver to turn it to maximum brightness.
3. Using the insulated screwdriver, turn the GAIN control (Figure 12, #1) to its midpoint (approximate center).
4. Using the insulated screwdriver, turn the sub-brightness (SUB BRIGHT) control (Figure 12, #2) to its full clockwise position. This increases the brightness of the display.

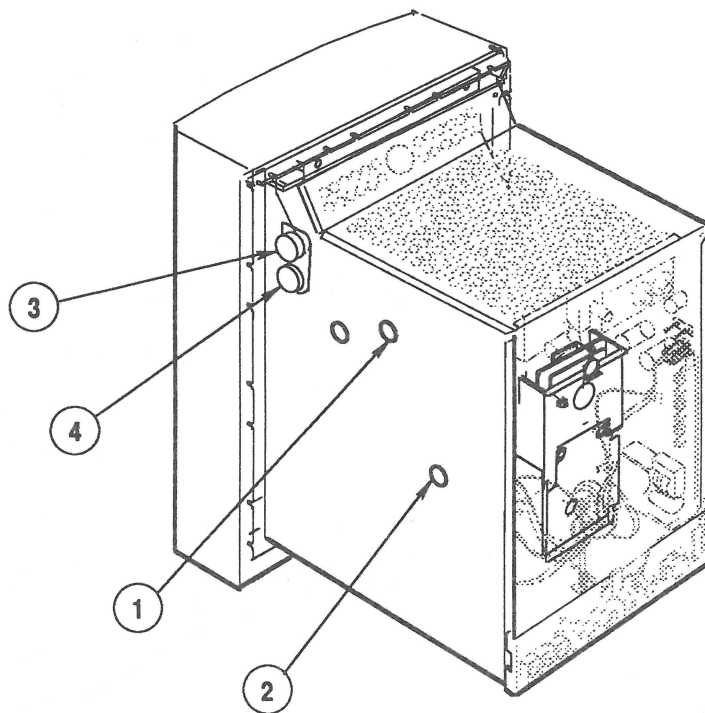


FIGURE 12

5. Display the **Full Black Screen** test pattern on the monitor (see "Test Patterns"). (Because adjustment controls have been turned up, the **Full Black Screen** test pattern will appear to be a milky gray rather than dark black.)
6. Set the BRIGHTNESS (Figure 12, #3) and CONTRAST (Figure 12, #4) controls at maximum (full clockwise).

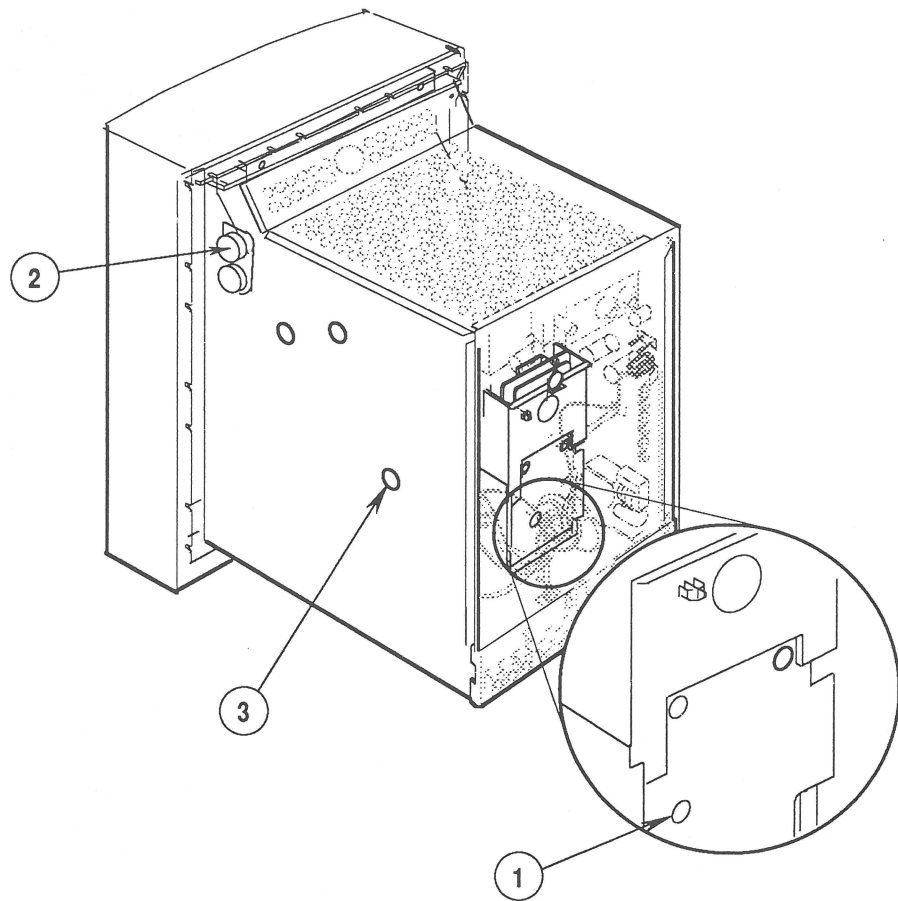


FIGURE 13

IMPORTANT: When setting the cutoff control, do not turn up screen brightness too high or the monitor may shut down. If this happens, turn down the cutoff control and switch off monitor power. Wait 30 seconds, switch on monitor power, and resume the procedure.

Note: Retrace lines are the thin, horizontal lines that can be seen when display brightness is set too high.

7. Using the insulated screwdriver, turn the CUTOFF control (Figure 13, #1) clockwise until retrace lines are just visible on the display. Then back off (turn counterclockwise) the CUTOFF control until the retrace lines **just completely disappear**.

Note: If you are having difficulty determining when the retrace lines just disappear, try reducing the ambient (room) light on the screen.

8. Display the **Gray Bars** test pattern on the monitor (see "Test Patterns").
9. Set the BRIGHTNESS control (Figure 13, #2) to the detent position. (To identify the detent position, turn the knob and locate the place at midrange where the knob hesitates.)
10. Using the insulated screwdriver, adjust the sub-brightness (SUB BRIGHT) control (Figure 13, #3) so that the first bar (only) is completely black. The first bar should match the black border at the top 1/8 inch of the screen.

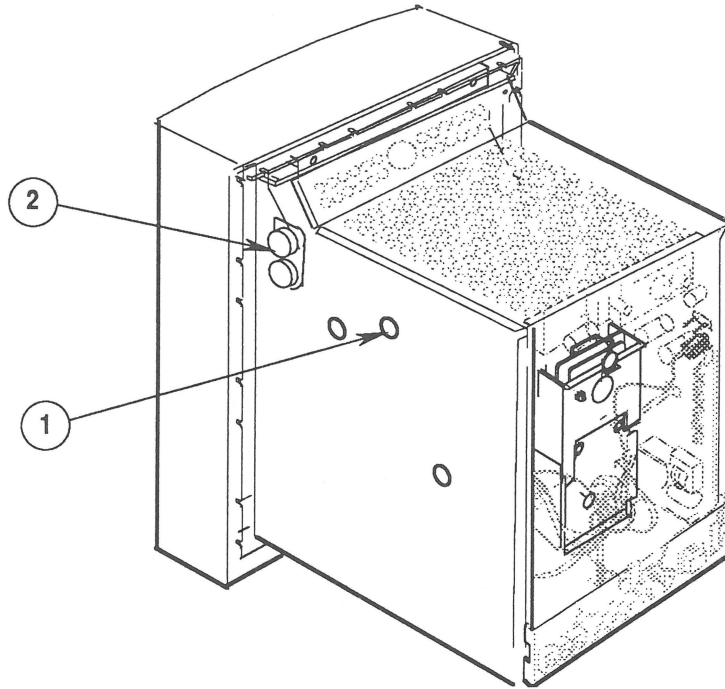


FIGURE 14

11. Display the **Full White Screen** test pattern on the monitor (see "Test Patterns").
12. Make sure the BRIGHTNESS control is at the detent position, and measure screen luminance with the light meter. The light meter should read at the low end of the 11 scale (40 ft.-lamberts) (see Figure 15, #1).

If screen luminance is too high or low, use the insulated screwdriver to turn the GAIN control (Figure 14, #1) until you obtain a correct reading at the light meter. (See "Using the Light Meter to Measure Screen Luminance" later in this section for more information.)

13. Set the BRIGHTNESS control at maximum (full clockwise), and recheck screen luminance with the light meter. The light meter should not measure beyond the 11 scale (above 60 ft.-lamberts) (see Figure 15, #2).

If screen luminance measures out of the 11 scale (over 60 ft.-lamberts) on the light meter, repeat the procedure above, beginning with step 8.

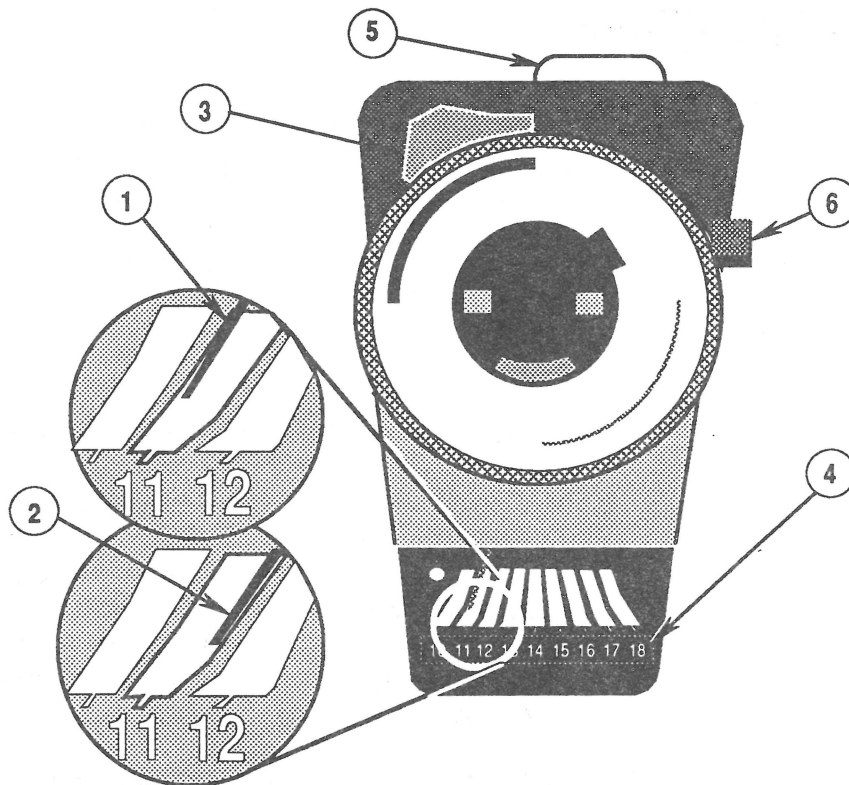


FIGURE 15

*Using the Light Meter
to Measure
Screen Luminance*

Use the light meter to measure the screen luminance of the Portrait Display as follows:

1. Verify that the light meter is functioning correctly by pressing the red button on the back of the meter. If the reading moves to the right of the red notch, replace the battery.
2. Move the side switch (Figure 15, #3) up so that the lower scale (Figure 15, #4) reads 10 through 18.
3. Move the lens hood (Figure 15, #5) aside to uncover the lens of the meter. Place the lens against the screen exactly at screen center, press the "read" button (Figure 15, #6), and obtain the light meter reading on the lower scale (Figure 15, #4).

□ MAGNET ADJUSTMENT

Some early manufactured units of the Apple Portrait Display may exhibit distortion along the upper edge of the screen. This bowing or bulging distortion occurs most commonly in the upper-left corner of the screen near the menu bar, but can also occur in the upper-right corner of the screen or in both corners as shown in Figure 16. The distortion problem can be corrected with magnets.

Use the following procedure and the six magnets provided in the Adjustment Magnet Kit to correct the distortion problem. **Always use the weakest magnet that will correct the distortion problem, and always adjust any distortion in the upper-left corner of the screen first.** After adjusting any distortion in the left corner of the screen, repeat the same steps to correct any unacceptable distortion in the upper-right corner of the screen.

Note: Do not adjust distortion in the upper-right corner of the screen unless the distortion is severe enough to render the display unacceptable to the customer.

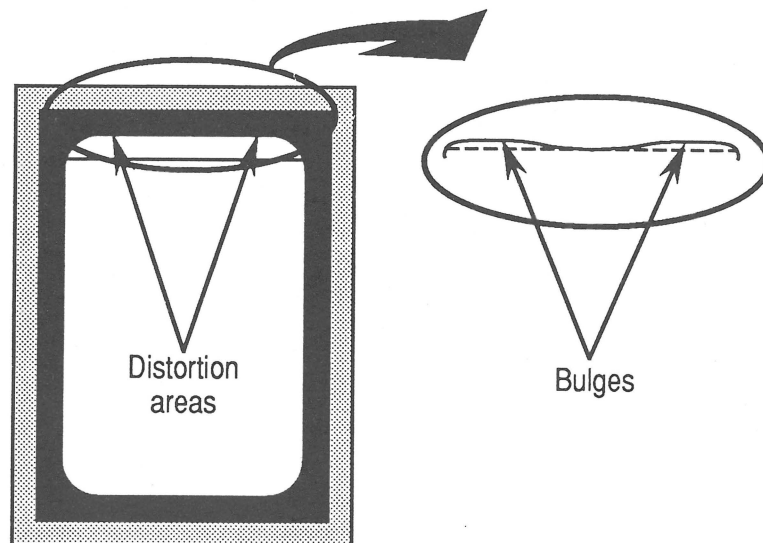


FIGURE 16

Materials Required

Adjustment Magnet Kit
Silicone rubber glue (also used as bathroom tub sealant)
Black electrical tape
Plastic packaging paper

Adjustment Procedure

WARNING: Use extreme care when operating the monitor with the cover and EMI shield removed. Follow the standard safety precautions outlined in Section 1, Basics, and do not touch any part not specifically called out in the adjustment procedure that follows.

1. Remove the rear cover and the EMI shield.

CAUTION: With the rear panel of the EMI shield removed, the signal input board assembly is loose and could short to chassis ground. To prevent damaging the monitor, reinstall the three mounting screws (Figure 17, #1) in the metal brackets and chassis.

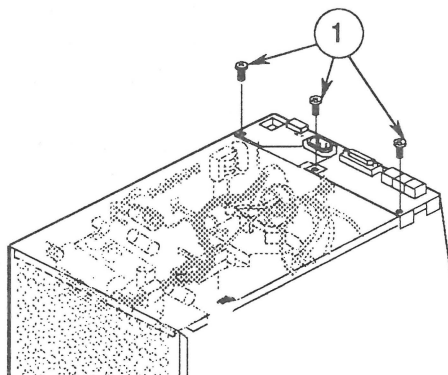


FIGURE 17

2. Place the monitor upright on a grounded workbench pad. (Do **not** put on a grounding wriststrap.)

WARNING: The main deflection board (Figure 18, #1) contains high-voltage components. To prevent touching high-voltage areas on the main deflection board, cover the board with plastic packaging paper before performing the adjustment procedure. Make sure transistor Q711 is covered.

3. Cover the main deflection board (Figure 18, #1) with plastic packaging paper. To keep the packaging paper in place, tape it to the plastic on top of the yoke assembly (Figure 18, #2).
4. Connect the video cable and power cable to the rear of the Portrait Display and switch on monitor power. Use the Macintosh desktop display to perform the adjustment procedure.
5. If the upper-left corner of the screen is distorted, place the weakest (green) magnet (Figure 18, #3) on the back of the CRT to the right of the anode cap as shown in Figure 18. **While looking at the screen display, both rotate the magnet and move the magnet from side-to-side and up-and-down until you get the least distortion.** (Use trial-and-error to locate the best position for the magnet, which could be anywhere between the top outside corner of the CRT to just below the anode cap near the center of the CRT.)

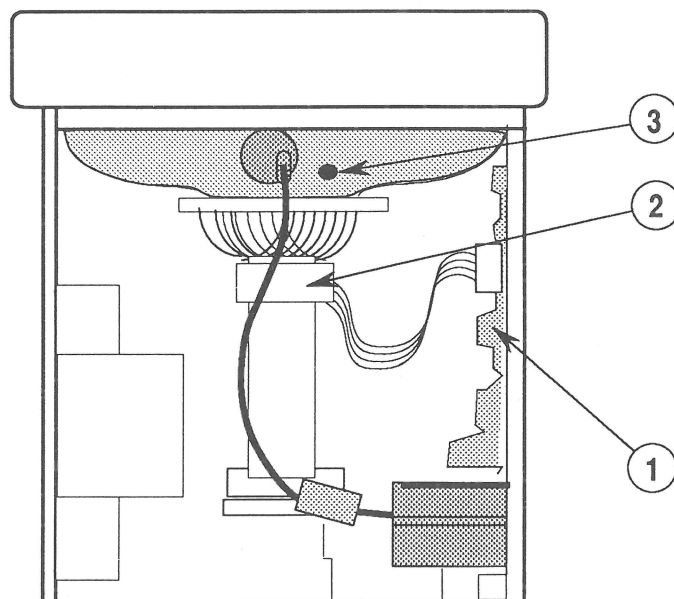


FIGURE 18

If the weakest magnet is unable to correct the distortion, try the next strongest (white) magnet.
From weakest to strongest, the magnets are color-coded as follows:

- Green (weakest)
- White
- Not colored
- Red (strongest)

Note: If you should drop a magnet into the monitor, be sure to switch off monitor power and remove all cables before retrieving the magnet.

6. When you have found the magnet that best eliminates the distortion problem, note its approximate position on the back of the CRT.
7. Liberally apply silicone sealant to the back of the magnet, and replace it on the back of the CRT. Rotate and move the magnet as necessary to get the best possible picture, and then tape the magnet into position with black electrical tape.
8. If the upper-right corner of the screen is distorted, place the weakest (green) magnet on the back of the CRT to the left of the anode cap and repeat steps 5 through 7.
9. Turn off power to the monitor, and allow the silicone glue to dry.
10. Replace the EMI shield and rear cover.

❑ MACTEST IIcx/IIci TEST PATTERNS

Materials Required

Macintosh IIcx or Macintosh IIci
Macintosh II Portrait Video Card (not required for Macintosh IIci)
MacTest™ IIcx/IIci diagnostic disk (version 2.0 or higher)

IMPORTANT: *The Macintosh II Portrait Video Card RAM must be upgraded to 512K in order to display the MacTest IIcx/IIci test patterns. Refer to the Macintosh Family Cards Technical Procedures.*

Generating the Test Patterns

MacTest IIcx/IIci tests the video RAM on video cards installed in Macintosh IIcx or IIci computers, and also displays test patterns used to adjust the monitor. Follow the steps below to test the video RAM or display the test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh IIcx or Macintosh IIci computer.
2. Boot the *MacTest IIcx/IIci* disk.
3. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect all default test selections.

Note: Apple recommends testing the video RAM before performing the video adjustments. To test video RAM on board a Macintosh IIci computer, you must run the **Short** or **Long RAM** logic test.

4. To test the video RAM on an installed video card, click **Video Card in Slot** and enter the appropriate slot number.
5. To display the video adjustment test patterns:
 - Click **Video Monitor Connected to Built-in Video**, or
 - Click **Video Monitor Connected to Selected Card**. (Be sure that the correct video card slot is entered in the Video Card in Slot box.)

6. Click **OK** to close the Test Selections window and return to the Start window.

Note: If built-in video is being used to generate the monitor test patterns, the memory allocation for the built-in video must be set to at least 16 grays/colors. From the Apple menu, open the Control Panel, click **Monitors**, click the highest number of Grays/Colors, and close the Control Panel.

7. From the Start window, click **Start** to proceed. You will encounter one or both of these scenarios:
 - If you chose to test the Portrait Video Card, the following message will appear on the main (boot) monitor: **Testing Macintosh II Portrait Video Card**. Horizontal and vertical lines will flash across the screen of the Portrait Display. After about one minute, the Status line in the Start window on the main monitor will indicate whether the video card has passed the test. Clicking **Start** again will display the first test pattern (if selected) or rerun the video card test.
 - If you chose to display only the monitor test patterns, the first (gray bars) test pattern will be displayed on the Portrait Display screen. Click the mouse to advance through the test patterns (each test pattern is displayed once). When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)
8. *MacTest IIcx/IIci* displays the test patterns listed below:
 - Gray Bars
 - Full White Screen
 - Full Black Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

Apple Macintosh Portrait Display

Section 4 – Troubleshooting

□ CONTENTS

4.2	Introduction
4.2	Monitor Inspection
4.4	Symptom Chart
4.4	Raster Problems
4.5	Video Display Problems
4.5	Miscellaneous Problems

□ INTRODUCTION

The monitor inspection procedure below should be performed whenever you replace a defective module in the Apple Macintosh Portrait Display. The procedure helps you identify common adjustment problems, and refers you to the symptom chart that follows for solutions to the problems.

The symptom chart for the Macintosh Portrait Display describes problems that may occur with the monitor, and then presents a list of possible solutions. Find the description that best matches the symptom(s) displayed by the monitor, and perform the corrective actions in the order listed.

If the first action does not fix the problem, try the next action on the list. If you replace a module and the problem still exists, reinstall the original module before performing the next repair action.

The symptom chart for the Portrait Display is divided into raster problems, video display problems, and miscellaneous problems. Raster problems are those affecting the lit portion of the screen only; video problems are those affecting the quality of the video image produced onscreen.

WARNING: Read all the safety precautions (see Section 1, Basics) and perform the CRT discharge procedure (see Section 2, Take-Apart) before removing or installing any modules.

Monitor Inspection

Perform the following inspection whenever you replace a defective module in the Macintosh Portrait Display. This inspection will help you identify monitor display problems. If recommended adjustments don't resolve the problem, refer to the symptom chart.

1. Display the **Gray Bars** test pattern on the monitor. (Refer to "Test Patterns" in Section 3, Adjustments.)
2. Set the BRIGHTNESS control at its center click (detent) position, and set the CONTRAST control at maximum (full clockwise).

3. Check that the following conditions are true:

- Bar 1 is completely black (like the border)
- Bars 2-16 display descending shades of gray
- Bar 16 (the white bar) measures low "11" (40 foot lamberts) on the light meter set to the high range (see Section 3, Adjustments)

If these conditions are not true, perform the video adjustments or refer to the symptom chart.

4. Display a **Crosshatch** test pattern on the monitor.
(Refer to "Test Patterns" in Section 3, Adjustments.)
5. Check the display for the following focus and geometric proportion problems. Refer to the symptom chart for a complete listing of focus and raster abnormalities and repair recommendations.

Geometric checks:

- If not 10 7/8 inches (276mm) high, adjust vertical size
- If not 8 inches (203mm) wide, adjust horizontal size
- If not centered (high or low), adjust vertical center
- If not centered (right or left), adjust horizontal center
- If the black margin on the right side of the display is not 1/4 inch (7mm), adjust horizontal phase
- If text characters are not the same size at the top and bottom of the display, adjust vertical linearity

Focus check:

- If characters are out of focus, adjust focus

Video checks:

- If bowed or barrel shaped, adjust side pincushion
- If the monitor shuts down, adjust video

□ SYMPTOM CHART

Raster Problems

Solutions

- | | |
|--|--|
| <ul style="list-style-type: none">• <i>No raster (LED does not light)</i> | <ol style="list-style-type: none">1. Check fuse; replace if blown. If it blows again, go to the next step.2. Replace main deflection board.3. Replace video board. |
| <ul style="list-style-type: none">• <i>No raster (LED is on)</i> | <ol style="list-style-type: none">1. Replace main deflection board.2. Replace CRT board.3. Replace video board. |
| <ul style="list-style-type: none">• <i>Raster not centered</i> | <ol style="list-style-type: none">1. Perform horizontal or vertical center adjustments.2. Replace main deflection board. |
| <ul style="list-style-type: none">• <i>Raster bulges along top of screen</i> | <ol style="list-style-type: none">1. Perform magnet adjustment procedure.2. Replace CRT assembly. |
| <ul style="list-style-type: none">• <i>Raster stretched or compressed at top</i> | <ol style="list-style-type: none">1. Perform vertical linearity adjustment.2. Replace main deflection board. |
| <ul style="list-style-type: none">• <i>One thin, bright, horizontal line appears across screen</i> | <ol style="list-style-type: none">1. Replace main deflection board.2. Replace cathode-ray tube (CRT). |
| <ul style="list-style-type: none">• <i>Raster short (not 10 7/8 inches high)</i> | <ol style="list-style-type: none">1. Perform vertical height adjustment.2. Replace main deflection board. |
| <ul style="list-style-type: none">• <i>Raster narrow (not 8 inches wide)</i> | <ol style="list-style-type: none">1. Perform horizontal size adjustment.2. Replace main deflection board. |
| <ul style="list-style-type: none">• <i>Raster bowed or barrel shaped</i> | <ol style="list-style-type: none">1. Perform video adjustment.2. Replace main deflection board. |

Raster Problems (continued)

Solutions

- *Raster pyramid shaped (or inverted pyramid)* – Replace the cathode-ray tube (CRT).

Video Display Problems

Solutions

- *Picture breaks into diagonal lines* – Replace main deflection board.
- *Picture rolls vertically* – Replace main deflection board.
- *Display too dark or too bright*
 1. Perform video adjustments.
 2. Replace CRT board.
 3. Replace video board.
 4. Replace contrast brightness board.
 5. Replace cathode-ray tube (CRT).
- *Out of focus*
 1. Perform focus adjustments.
 2. Replace main deflection board.
 3. Replace cathode-ray tube (CRT).

Miscellaneous Problems

Solutions

- *Black spots on screen (burnt phosphors)* – Replace cathode-ray tube (CRT).
- *Monitor emits high-pitched squeal* – Replace main deflection board.
- *Monitor shuts down*
 1. Perform video adjustments.
 2. Replace main deflection board.
 3. Replace CRT board.

Apple Macintosh Portrait Display

Illustrated Parts List

❑ CONTENTS

IPL.3 Macintosh Portrait Display —System Exploded View (Figure 1)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple Macintosh Portrait Display, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

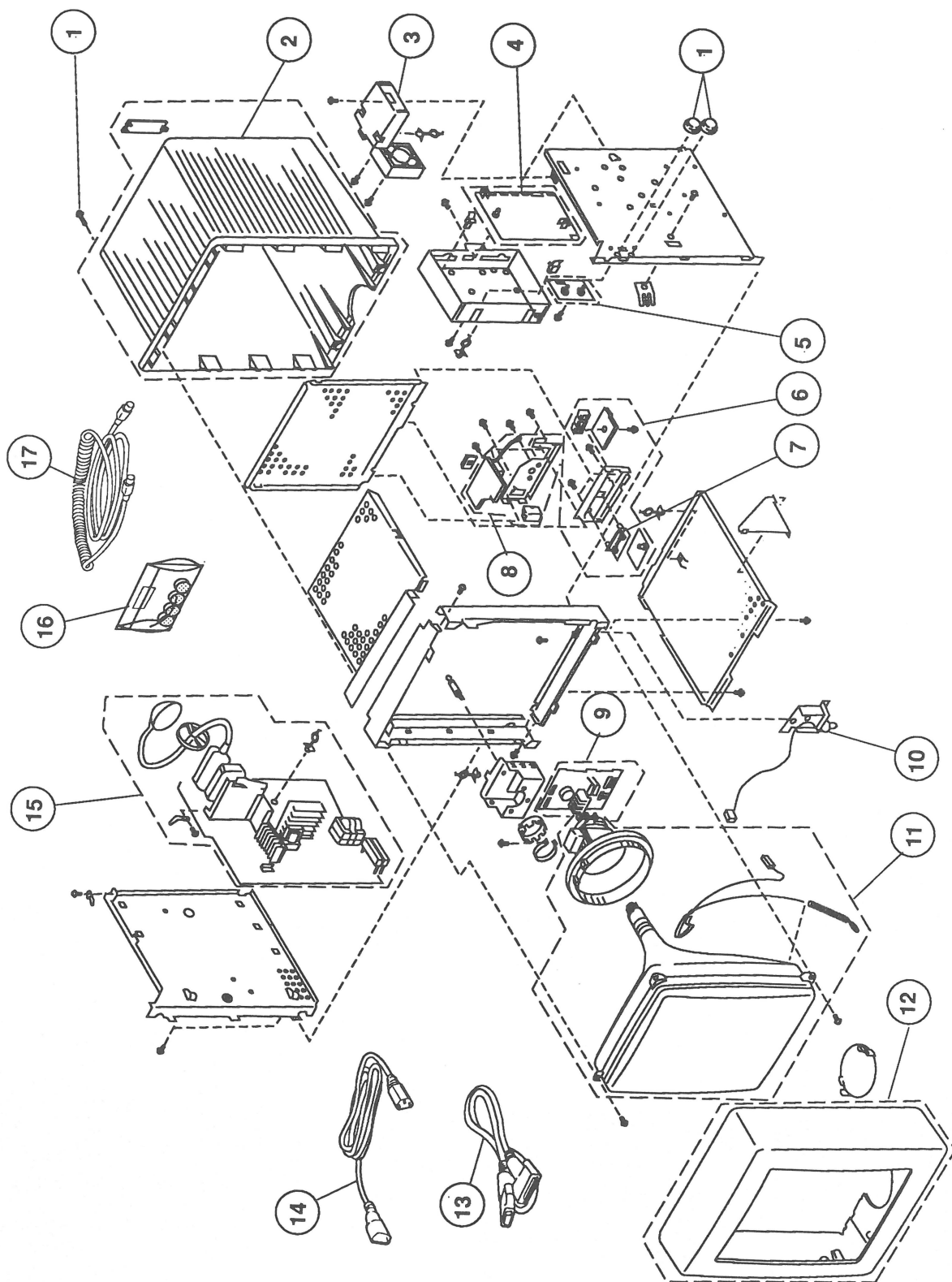


FIGURE 1

□ **MACINTOSH PORTRAIT DISPLAY—SYSTEM EXPLODED VIEW**
(Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	956-0015	Screw/Knob Set
2	949-0089	Plastic Rear Cover
3	983-0014	Fan
4	661-0118	Video Board
5	982-0004	Contrast/Brightness Board
6	937-0022	Signal Input Assembly
7	941-0017	Fuse, 250 V, 4 Amp, (5/pk)
8	937-0019	AC Input Assembly with Fuse
9	661-0119	CRT Video Board
10	590-0071	LED Cable Assembly
11	076-0350	CRT Assembly
12	949-0079	Plastic Bezel
13	590-0574	Video Cable, 1.9 m, DB-25 to DB-25
	590-0615	Video Cable, 1.9 m, DB-25 to DB-15
14	590-0371	Power Cable, 1.9 m, U.S.
	590-0421	Power Cable, 1.9 m, European
15	661-0117	Main Deflection Board
16	949-0253	Adjustment Magnet Kit
17	590-4501	Cable, ADB, 1.9 m

Apple Macintosh Portrait Display “Series B”

Technical Procedures

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- 2.10 Contrast Brightness Board
- 2.13 Dynamic Focus Board
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- 2.20 AC Input/Filter Assembly
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- 2.45 Bezel

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Apple Macintosh Portrait Display “Series B”

Section 1 – Basics

❑ CONTENTS

- 1.2 Product Description
- 1.3 Features
- 1.4 External Controls
- 1.5 External Connectors
- 1.6 Module Identification
- 1.8 Care and Handling

□ PRODUCT DESCRIPTION

The Apple® Macintosh® Portrait Display “Series B” is a high-resolution, 15-inch (diagonal) monochrome monitor that can be used with any Macintosh computer with a NuBus expansion slot.

Apple sells two versions of the Portrait Display. Currently, the “Series B” version is sold in Europe only. The display characteristics for both versions are identical, but their repair procedures are different. To quickly differentiate between versions, check the rear cover for the following (**Figure 1**):

- The model number near the top of the manufacturer's label (**Type: M0404** is the original Portrait Display; **Family: M0404Z/B** or **M0404S/A** is the “Series B” Portrait Display)
- The location of the external service controls
- The location of the power switch and AC power connector

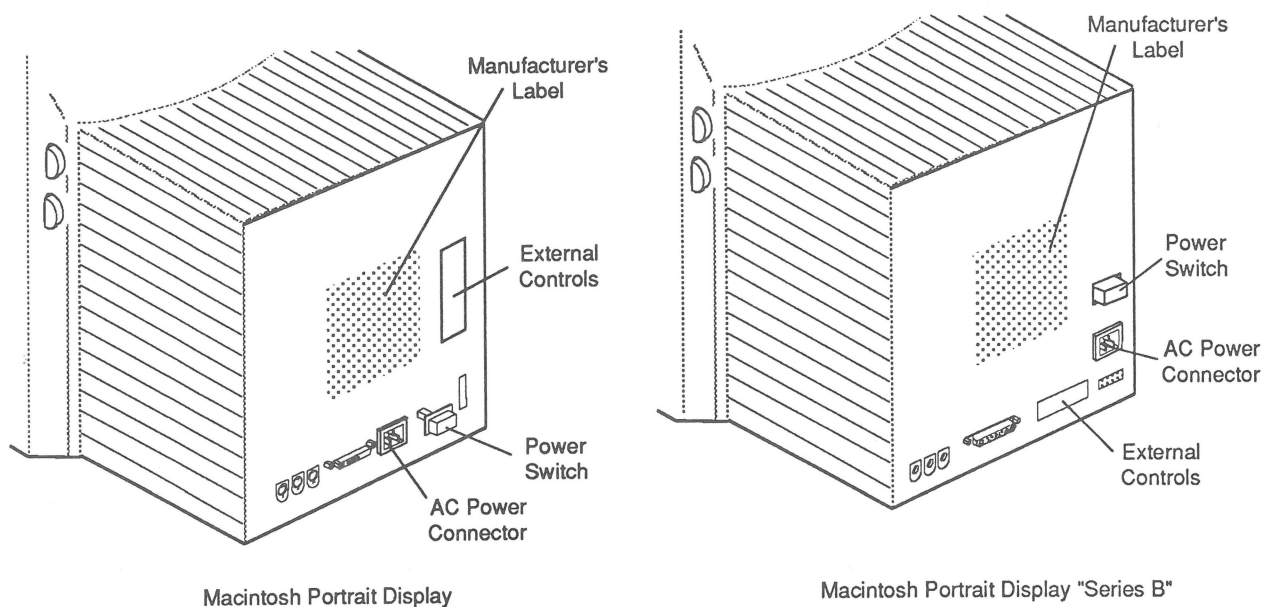


FIGURE 1

The Macintosh Portrait Display "Series B" is supported by the on-board video circuitry of the Macintosh IIfx. For other Macintosh systems one of the following video cards is required:

- Macintosh II Portrait Video Card
- Macintosh Display Card 4•8
- Macintosh Display Card 8•24
- Macintosh Display Card 8•24GC

The Macintosh Display Card 4•8 displays images in 4- or 8-bit modes—or up to 16 shades of gray on the Portrait Display. The Macintosh Display Card 8•24 and 8•24GC (with graphics accelerator) can display up to 256 shades of gray on the Portrait Display monitor. Refer to *Macintosh Family Cards Technical Procedures* for more information about these video cards.

Features

The Macintosh Portrait Display features a full-page display and 80 DPI (dots per inch) resolution, which makes it an ideal Macintosh companion for performing word processing and desktop publishing applications. The Portrait Display also features:

- A flat-faced, square-cornered picture tube for page-like display
- 640 horizontal by 870 vertical pixels
- A crisp, flicker-free display
- A high-contrast, antiglare screen
- Up to 256 shades of gray (with the 24-bit video card)
- A universal power supply
- 75 Hz refresh rate
- Three Apple Desktop Bus™ (ADB) ports
- Compatibility with Apple Universal Monitor Stand

External Controls

The power switch, contrast control, and brightness control (**Figure 2**) are the only external controls recommended for user access. The brightness control has a detent for midrange reference. A green/yellow LED at the lower-right, front corner of the bezel indicates when power to the Portrait Display is on.

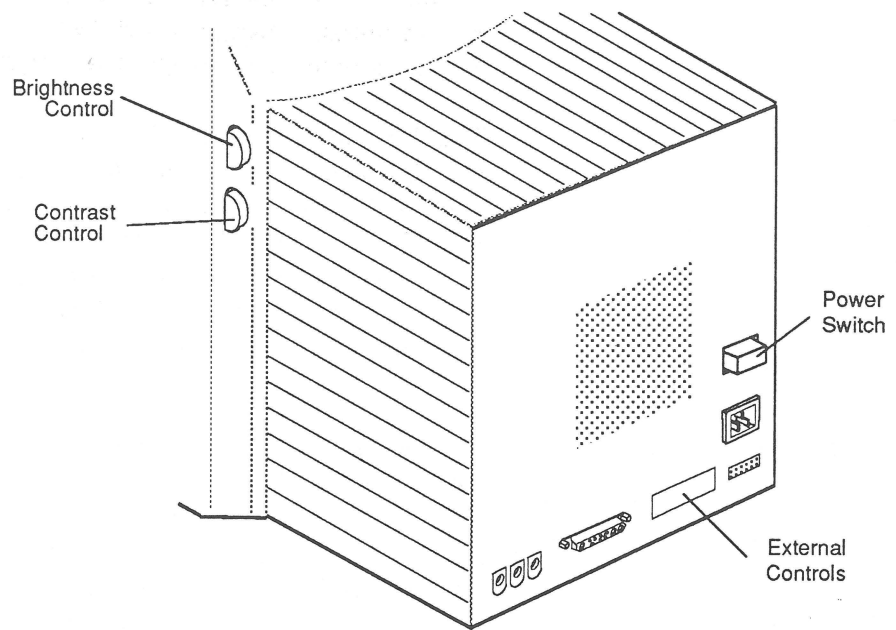


FIGURE 2

Three adjustment controls are at the back of the Portrait Display, under a snap-out door (**Figure 2**). These are not user controls, but well-meaning users may sometimes misalign them. The internationally recognized symbols shown in **Figure 3** are used to identify these three external adjustment controls:

- Height, or vertical amplitude (V.AMP)
- Vertical centering (V.CENT)
- Horizontal centering (H.CENT)

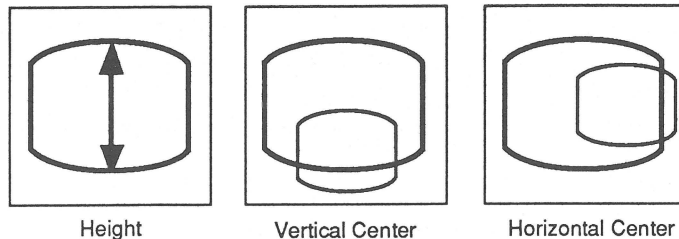


FIGURE 3

External Connectors

Five external connectors (three Apple Desktop Bus ports, the video connector, and the power socket) and the opening for an attachable security lock are located at the back of the Macintosh Portrait Display, as shown in **Figure 4**.

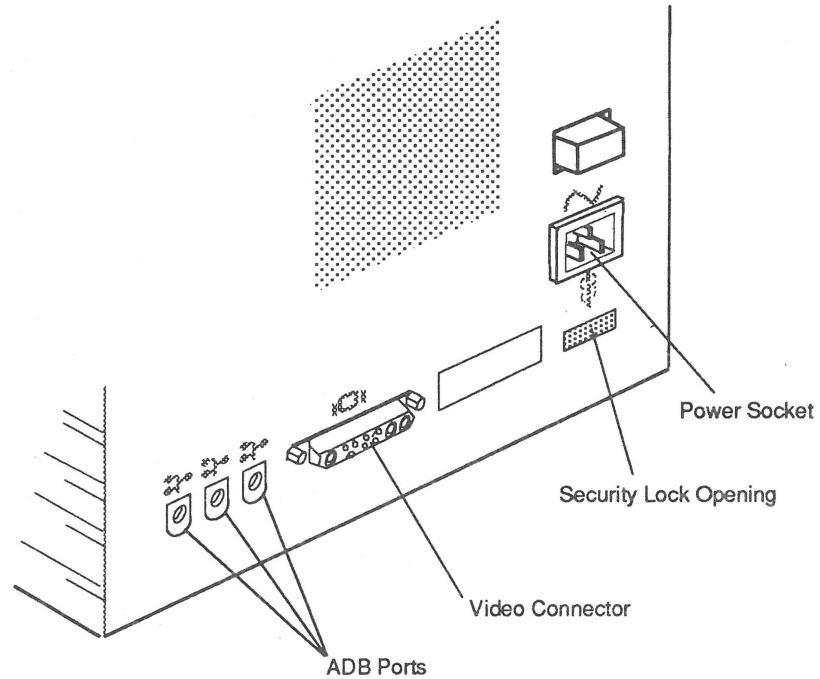


FIGURE 4

The three ADB ports enable users to connect ADB input devices (such as a keyboard or mouse) directly to the Portrait Display. The ADB ports provide a path for information to flow from the input device through the monitor to the computer, which allows the user to separate desktop devices from the CPU.

In order to complete this ADB circuit, an ADB cable is included with finished-goods Portrait Displays. This cable should be connected between ADB ports on the monitor and CPU. Input devices can then be connected to the unused ADB ports on the monitor.

□ MODULE IDENTIFICATION

Most modules and replacement parts in the Macintosh Portrait Display are accessed merely by removing the rear cover and the top panel of the EMI shield. Also, most adjustments can be performed with only the rear cover and top shield panel removed.

However, the procedures for replacing some components (the main deflection board, CRT assembly, LED cable assembly, and bezel) are more elaborate. These procedures require removing the bottom panel of the EMI shield and separating the monitor chassis from the bezel.

No new tools are required to repair and service the Portrait Display.

The Portrait Display includes the exchange modules and replaceable parts listed below and shown in **Figure 5**.

- CRT (cathode-ray tube)
- Contrast brightness board
- Dynamic focus board
- Video board
- Main deflection board
- AC input/filter assembly
- On/Off switch assembly
- Fuse
- Rear cover
- LED cable assembly
- Bezel

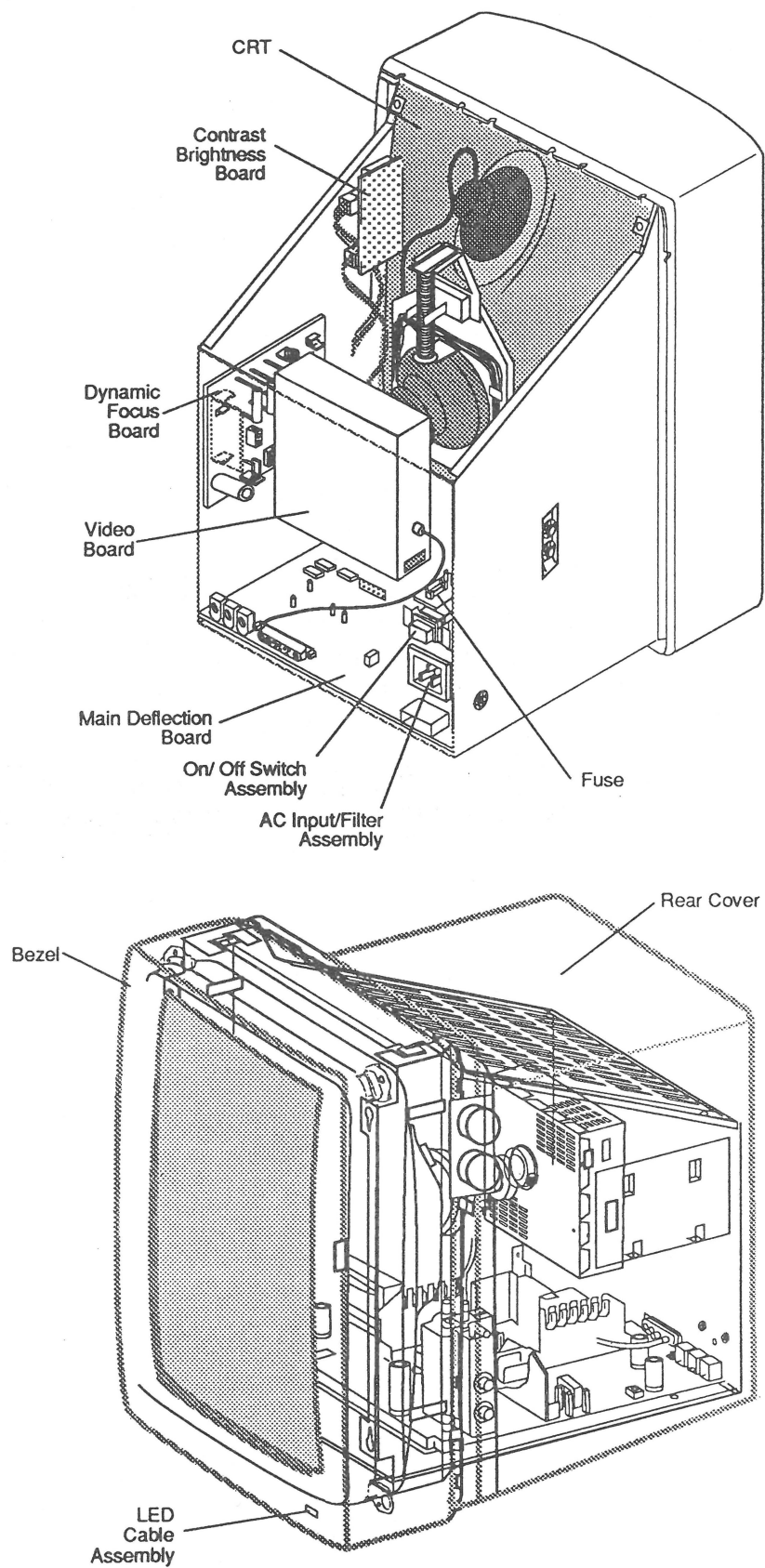


FIGURE 5

□ CARE AND HANDLING

The Apple Macintosh Portrait Display is a complex precision instrument that must be handled with care to ensure perfect operation. Dropping the monitor, however slightly, can cause CRT alignment problems.

Keep service modules and finished-goods monitors in the Apple packaging until use, and return modules to Apple for repair packed in approved module packaging.

Dispose of defective CRT assemblies, do not return them to Apple. Refer to "Disposing of the Cathode-Ray Tube" under You Oughta Know in the *Cross Family Peripheral Technical Procedures*.

The Apple Macintosh Portrait Display "Series B" contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), scattering glass in all directions.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

Apple Macintosh Portrait Display "Series B"

Section 2 – Take-Apart

□ CONTENTS

2.2	Rear Cover
2.4	Electromagnetic Interference (EMI) Shield
2.7	Discharging the Cathode-Ray Tube (CRT)
2.8	Discharge Procedure
2.9	Anode Cap
2.10	Contrast Brightness Board
2.13	Dynamic Focus Board
2.16	On/Off Switch Assembly
2.19	Fuse
2.20	AC Input/Filter Assembly
2.23	Video Board
2.34	Main Deflection Board
2.41	Cathode-Ray Tube (CRT)
2.43	LED Cable Assembly
2.45	Bezel

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in the section.

□ REAR COVER

Note: The following Take-Apart procedures are for the “Series B” (European) version of the Macintosh Portrait Display only. To differentiate between monitors, check the product name at the top of the manufacturer’s label on the rear cover.

WARNING: The Macintosh Portrait Display “Series B” contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the back cover. **Failure to follow the safety rules could result in serious injury.**

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off the monitor and disconnect the AC power cord and video cable.
2. Place the monitor face down on a soft, protective surface to avoid damaging the CRT screen.

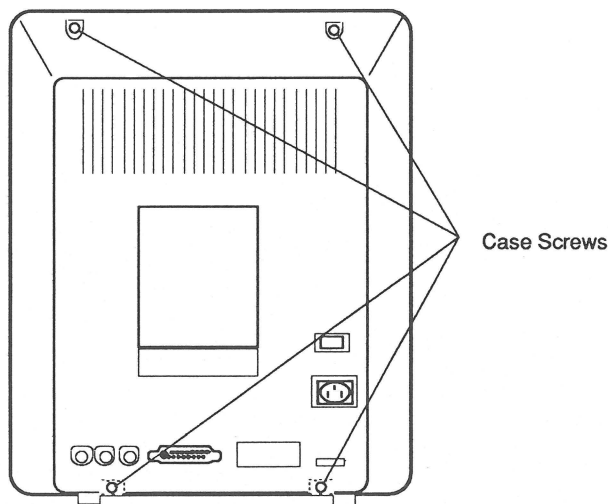


FIGURE 1

3. Remove the four case screws (**Figure 1**) from the rear cover.
4. Lift the rear cover off the bezel and set it aside.

Replace

1. Carefully set the monitor face down on a soft, protective surface.
2. Slide the rear cover onto the bezel, and replace the four case screws (**Figure 1**).
3. Carefully set the monitor upright.

❑ ELECTROMAGNETIC INTERFERENCE (EMI) SHIELD

The EMI shield consists of two metal panels secured to the top and bottom of the monitor chassis. **Only the top panel must be removed to discharge the Portrait Display monitor and access most of its replaceable modules and parts.** The bottom panel must be removed if you are replacing the video board, main deflection board, CRT assembly, LED cable assembly, or bezel.

Most monitor adjustments can be performed without removing the EMI shield.

Materials Required

Small Phillips screwdriver

Remove

1. Remove the rear cover.
2. Place the monitor upright on the protective pad.

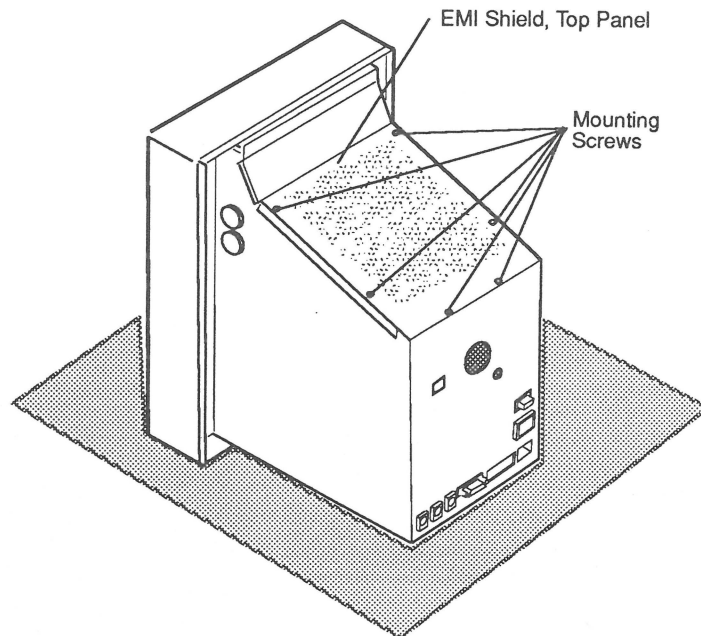


FIGURE 2

3. Remove the six screws that secure the top panel of the EMI shield to the chassis (**Figure 2**). Pull the top panel off the chassis.
4. Discharge the cathode-ray tube (CRT).

Note: Perform steps 5 and 6 for removing the bottom panel of the EMI shield only if you are replacing the video board, main deflection board, CRT assembly, LED cable assembly, or the bezel.

5. Carefully place the monitor on its side, with the bottom of the monitor facing you.

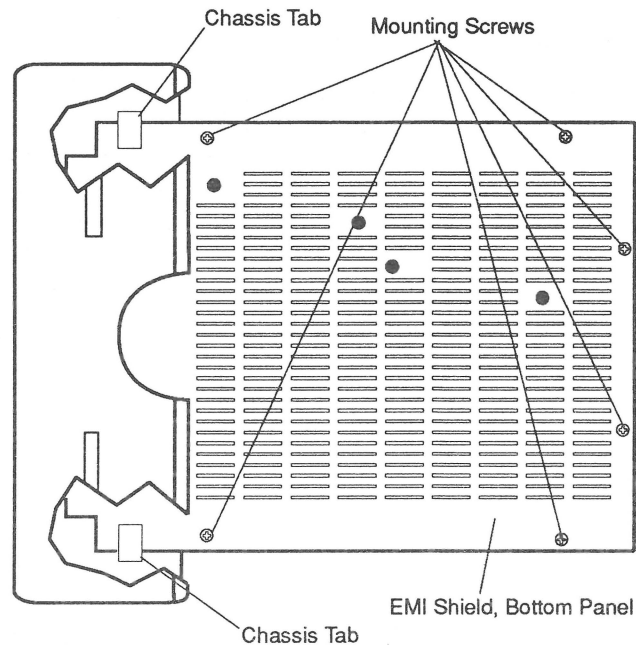


FIGURE 3

6. Remove the six screws that secure the bottom panel of the EMI shield to the chassis (**Figure 3**). Pull the bottom panel off the chassis.

Replace

Note: Perform steps 1 and 2 only if you have removed the bottom panel of the EMI shield.

1. Carefully place the monitor on its side on a soft, protective surface, with the bottom of the monitor facing you.
2. Push the notched end of the bottom panel under the two chassis tabs as shown in **Figure 3**. Then align the holes in the bottom panel and the chassis, and install the six mounting screws.

3. Place the monitor upright on the protective pad.

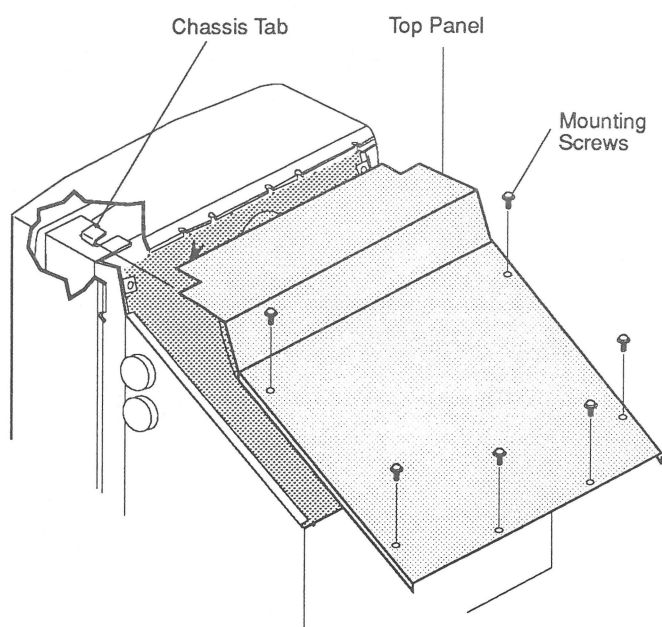


FIGURE 4

4. Push the notched end of the top panel under two chassis tabs as shown in **Figure 4**. Align the holes in the top panel and chassis, and install the six mounting screws.
5. Replace the rear cover.

❑ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The Macintosh Portrait Display is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. **Follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.**

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number 076-0381)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the You Oughta Know tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.

WARNING: To prevent serious injury, before discharging the CRT never touch the yoke wires, the anode wire, the anode connector, the three high-voltage resistors on the dynamic focus board, or the flyback transformer (see Figure 5).

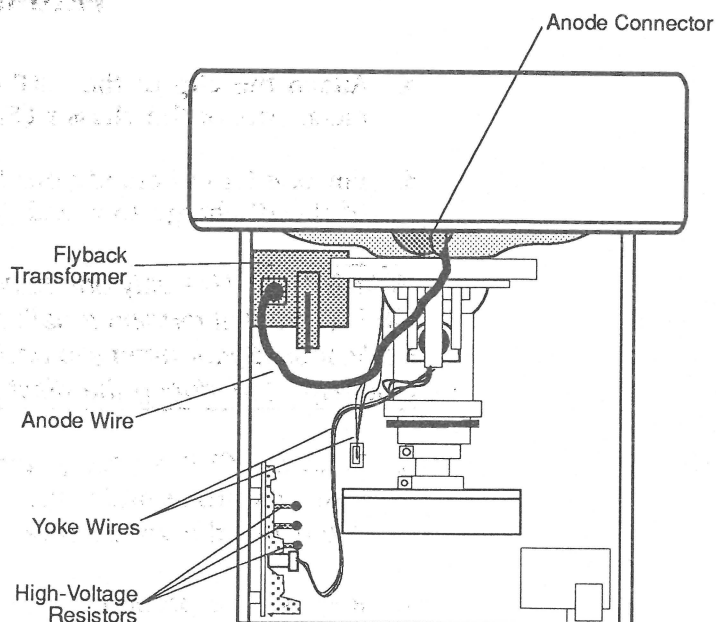


FIGURE 5

Discharge Procedure

1. Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!
2. Remove the rear cover and the top panel of the EMI shield.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

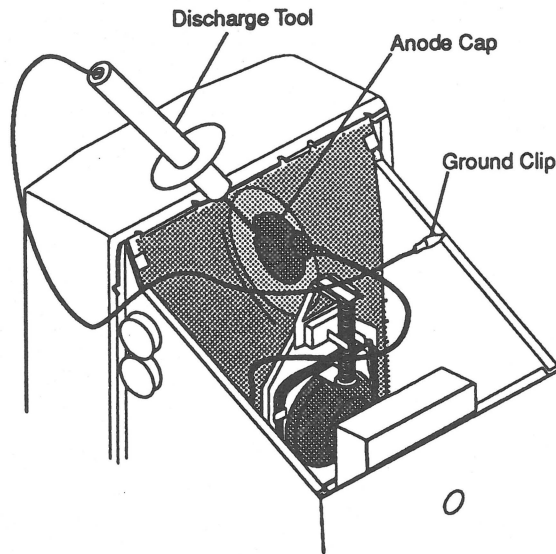


FIGURE 6

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (**Figure 6**).
5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (**Figure 6**) until it touches the anode ring.
7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: If the bleeder resistor fails, a secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode aperture.

Anode Cap

For some procedures, you may have to remove the anode cap (**Figure 7**). After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

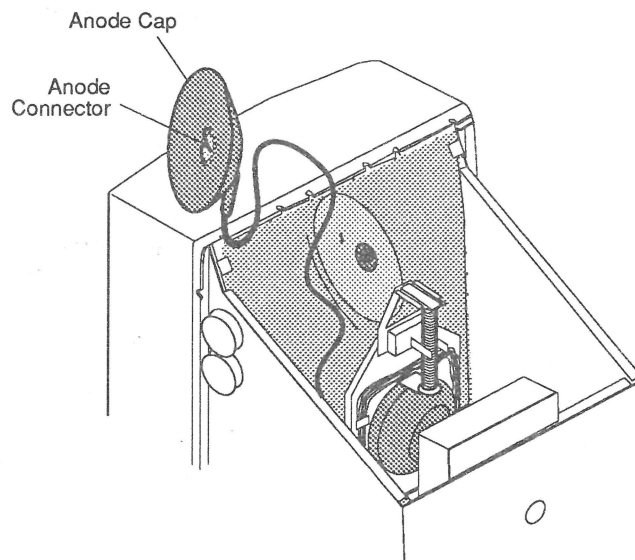


FIGURE 7

□ CONTRAST BRIGHTNESS BOARD

Materials Required

Small Phillips screwdriver
Medium flat-tip screwdriver
Small adjustable wrench

Remove

1. Remove the rear cover and top panel of the EMI shield.
2. Discharge the CRT.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after you have discharged the CRT.)
4. Disconnect the following connectors from the contrast brightness board (**Figure 8**):
 - 2-wire, 3-pin connector
 - 4-wire connector

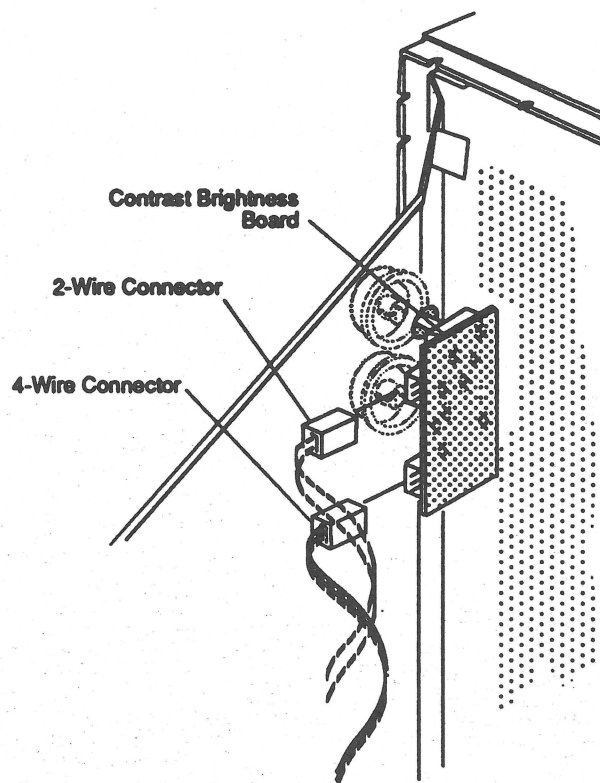


FIGURE 8

5. Pull off the two plastic control knobs (**Figure 9**). Keep the knobs to install them on the replacement board.
6. Using an adjustable wrench, loosen and remove the two hex nuts from the two adjustment knobs, and remove the contrast brightness board (**Figure 9**).

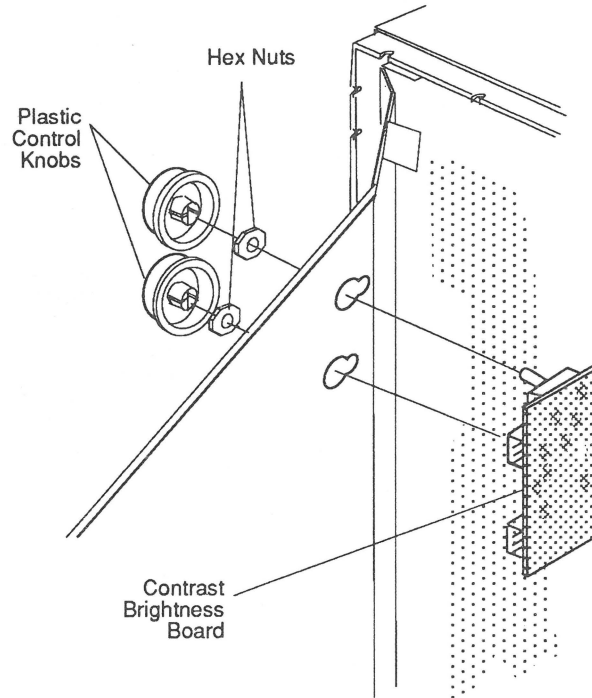


FIGURE 9

Replace

1. Replace the contrast brightness board (**Figure 9**) on the chassis, and install the two hex nuts. Tighten the nuts with an adjustable wrench.
2. Replace the two control knobs (**Figure 9**).

3. Reconnect the following connectors to the contrast brightness board (**Figure 10**).

- 4-wire connector
- 2-wire, 3-pin connector

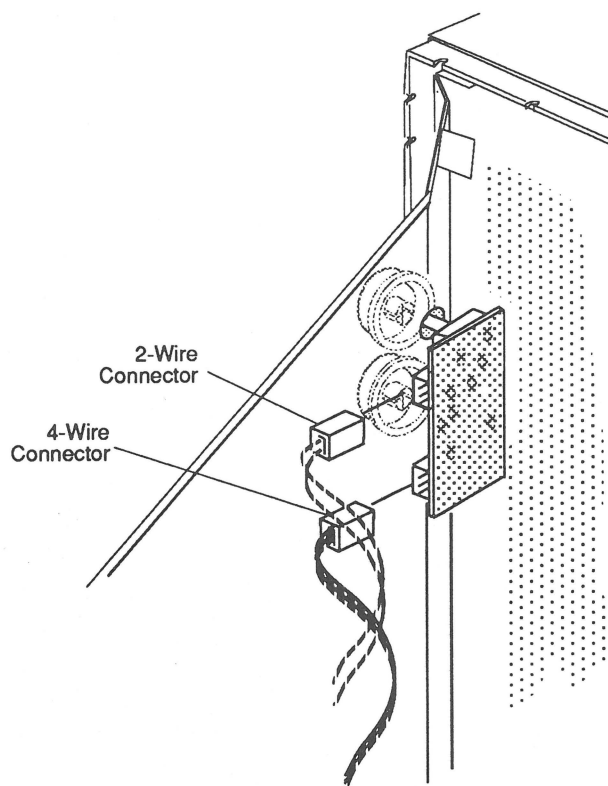


FIGURE 10

4. Replace the top panel of the EMI shield.
5. Replace the rear cover.

□ DYNAMIC FOCUS BOARD

Remove

1. Remove the rear cover and the top panel of the EMI shield, and discharge the CRT.
2. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).

WARNING: When removing connectors from the dynamic focus board, be careful not to touch resistors R517, R518, or R520 (**Figure 11**). These are high-voltage resistors.

3. Disconnect the following connectors from the dynamic focus board (**Figure 11**):
 - Single-wire connector (labelled **CO** on the dynamic focus board)
 - 2-wire, 4-pin connector (labelled **CP**)
 - 2-wire connector (labelled **CQ**)
 - 6-wire connector (labelled **CI**)

Note: To disconnect connector **CQ** you must first depress its two plastic release tabs.

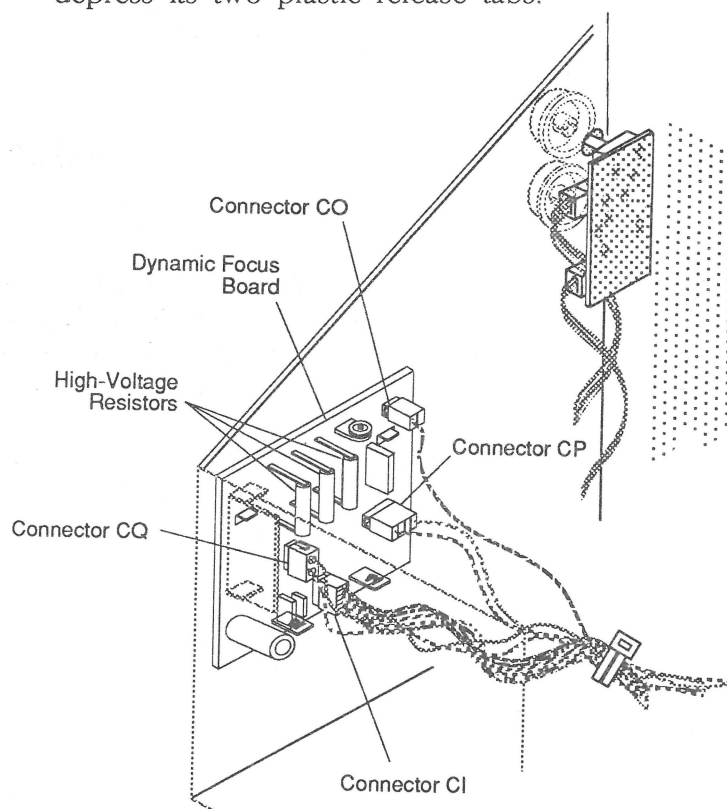


FIGURE 11

4. Pull up on two plastic mounting tabs (**Figure 12**) to release the dynamic focus board from the chassis. Carefully lift out the board.

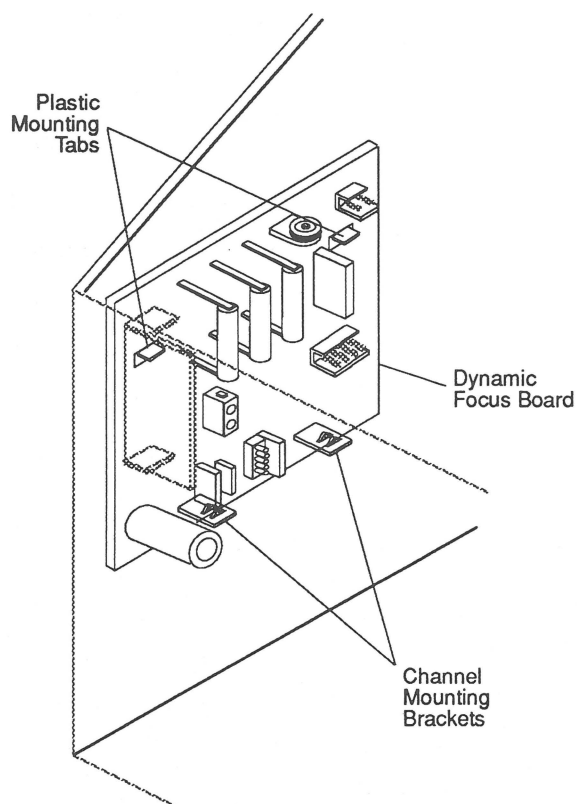


FIGURE 12

Replace

1. Place the dynamic focus board onto the two chassis mounting brackets (**Figure 12**). Be sure the two notches along the bottom of the board are placed between channel locks on the mounting brackets.
2. Align the two plastic mounting tabs with the mounting holes in the top of the board (**Figure 12**). Pull back on the top of the board until it snaps securely onto the mounting tabs.

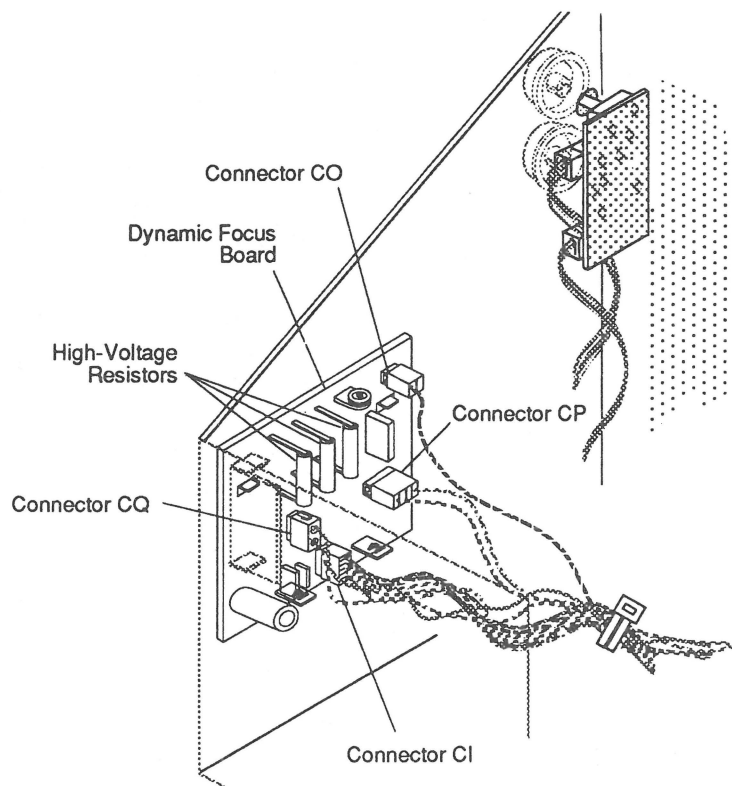


FIGURE 13

3. Reconnect the following connectors to the dynamic focus board (**Figure 13**):
 - 6-wire connector to **CI**
 - 2-wire connector to **CQ** (push until its two plastic release tabs lock in place)
 - 2-wire, 4-pin connector to **CP**
 - Single-wire connector to **CO**
4. Replace the top panel of the EMI shield.
5. Replace the rear cover.

□ ON/OFF SWITCH ASSEMBLY

Materials Required

Small Phillips screwdriver
Medium flat-blade screwdriver

Remove

1. Remove the rear cover and the top panel of the EMI shield, and discharge the CRT.
2. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).
3. Pull the plastic knob off the on/off switch (Figure 14).

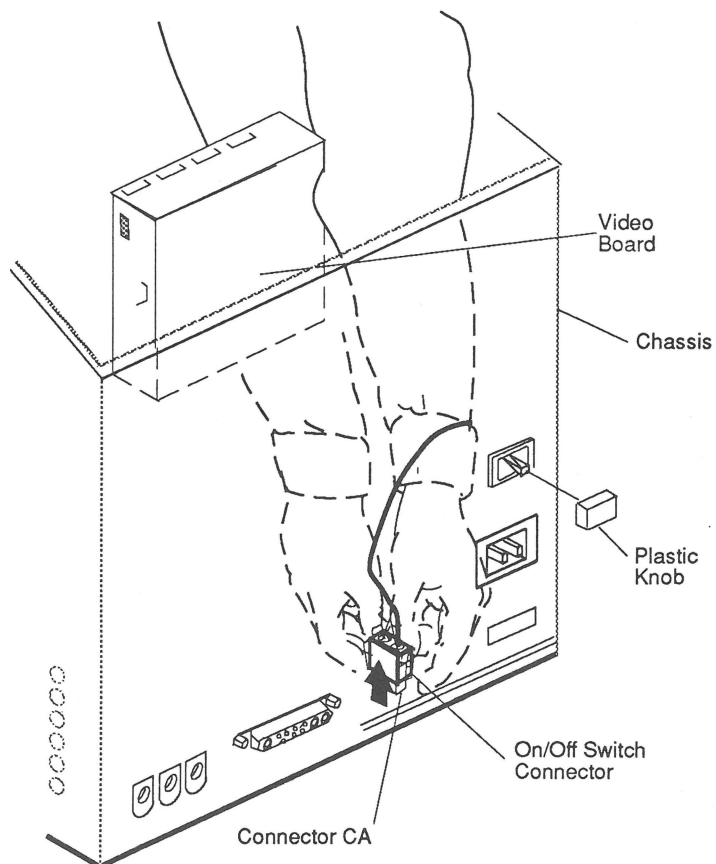


FIGURE 14

WARNING: The neck of the CRT can be easily damaged. Be careful not to apply excessive pressure on the video board when removing the on/off switch connector.

4. Disconnect the 2-wire, on/off switch connector (**Figure 14**) from the connector labelled **CA** on the main deflection board. (Suggestion: To remove the on/off switch connector, insert your right hand around and beneath the video board as shown in **Figure 14**, and insert your left hand between the video board and the rear of the chassis. Be sure to release the tabs on the sides of the connector.)
5. Disconnect the power input connector (**Figure 15**) from the connector on the on/off switch board.

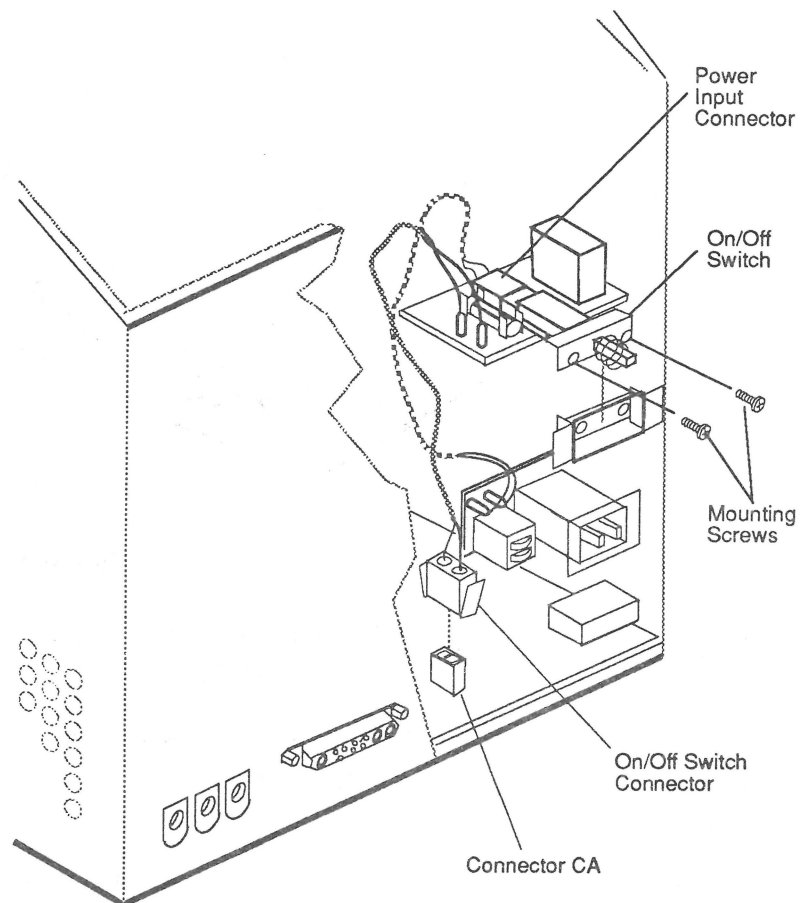


FIGURE 15

6. Remove two mounting screws (**Figure 15**), and remove the on/off switch from inside the chassis.

Replace

1. Replace the on/off switch on the chassis mounting bracket, and install the two mounting screws (**Figure 16**).

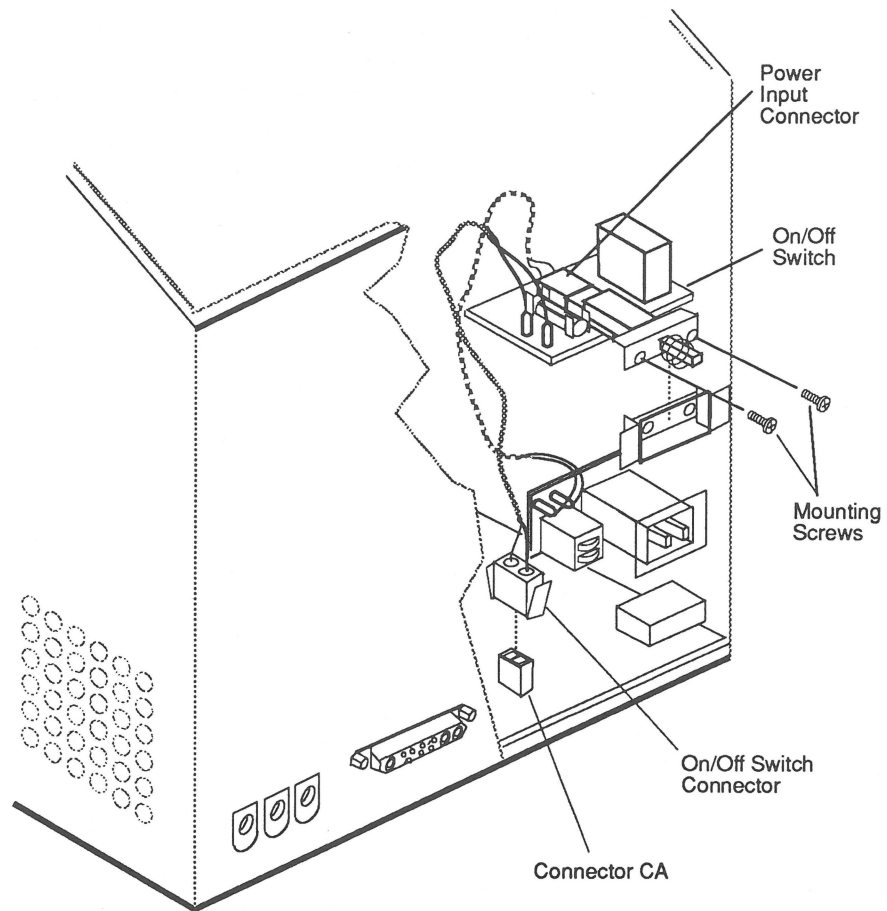


FIGURE 16

2. Connect the power input connector (**Figure 16**) to the connector on the on/off switch board.
3. Connect the 2-wire, on/off switch connector (**Figure 16**) to the connector labelled **CA** on the main deflection board.
4. Replace the plastic knob (**Figure 16**) on the on/off switch.
5. Replace the top panel of the EMI shield and the rear cover.

□ FUSE

Materials Required

Small flat-blade screwdriver

Remove

1. Remove the rear cover and the top panel of the EMI shield, and discharge the CRT.
2. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).
3. Remove the fuse from the on/off switch board (**Figure 17**). Gently pry up one end of the fuse with your fingers or a flat-blade screwdriver, and lift the fuse out of the holder.

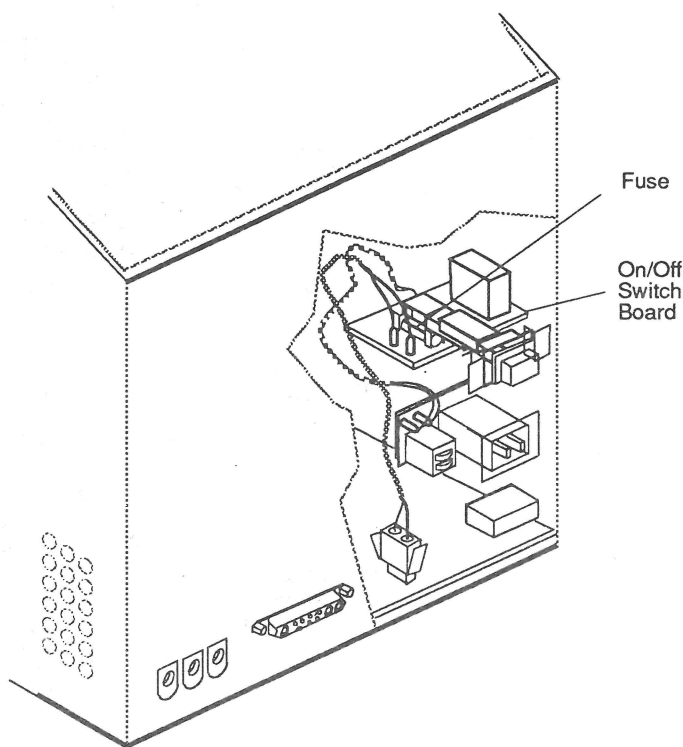


FIGURE 17

Replace

1. Using your fingers, carefully snap the new fuse into the fuse holder (**Figure 17**).
2. Replace the top panel of the EMI shield, and replace the rear cover.

□ AC INPUT/FILTER ASSEMBLY

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover and the top panel of the EMI shield, and discharge the CRT.
2. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).
3. Remove the on/off switch assembly.

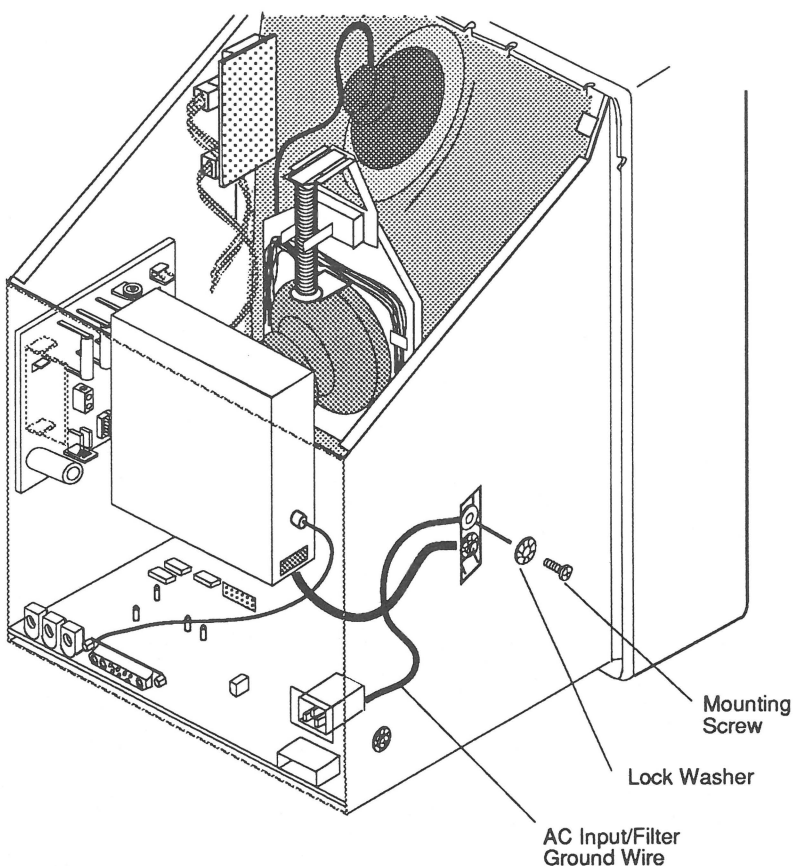


FIGURE 18

4. Remove the screw, lock washer, and AC input/filter ground wire from the ground bracket (**Figure 18**).

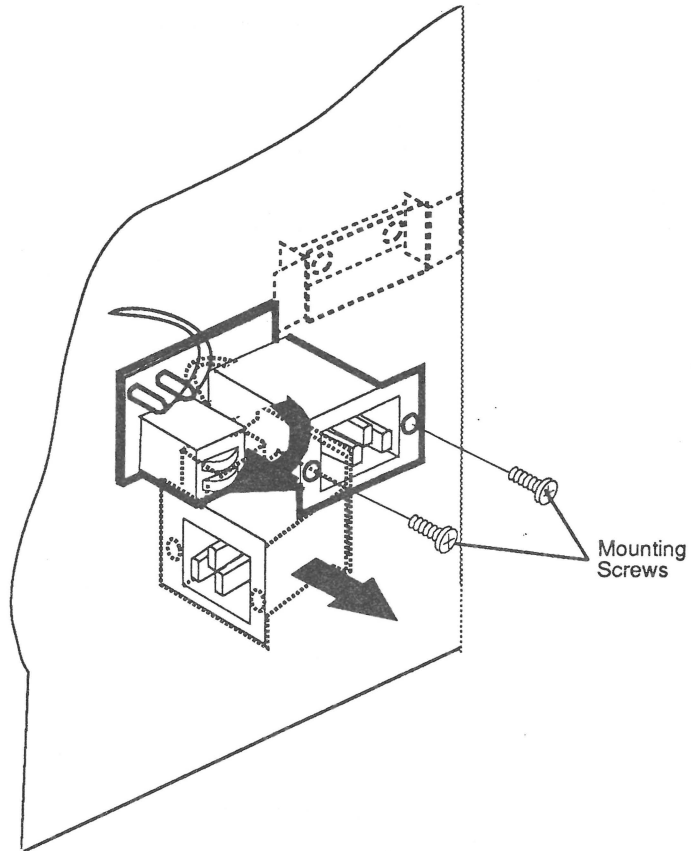


FIGURE 19

5. Remove the two mounting screws, and carefully remove the AC input/filter assembly through the mounting hole in the chassis (**Figure 19**). To remove the input/filter assembly, turn it left (clockwise) as you pull it through the mounting hole.

Replace

1. Install the new AC input/filter assembly on the chassis mounting bracket with two screws (**Figure 19**). To install the input/filter assembly, first insert the cables and filter board through the chassis mounting hole, and then turn the assembly to the right (counterclockwise) to insert the AC inlet.
2. Install the AC input/filter ground wire on the chassis ground bracket with a lock washer and a screw (**Figure 18**).

3. Replace the on/off switch assembly.
4. Replace the top panel of the EMI shield.
5. Replace the rear cover.

□ VIDEO BOARD

Materials Required

Medium Phillips screwdriver
Small needlenose pliers
Soldering iron and solder
Plastic tie-wrap

Remove

1. Remove the rear cover, and remove the top and bottom panels of the EMI shield.
2. Discharge the CRT, and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).
4. Remove the screw, lock washer, and large black video ground cable from the ground bracket (**Figure 20**).

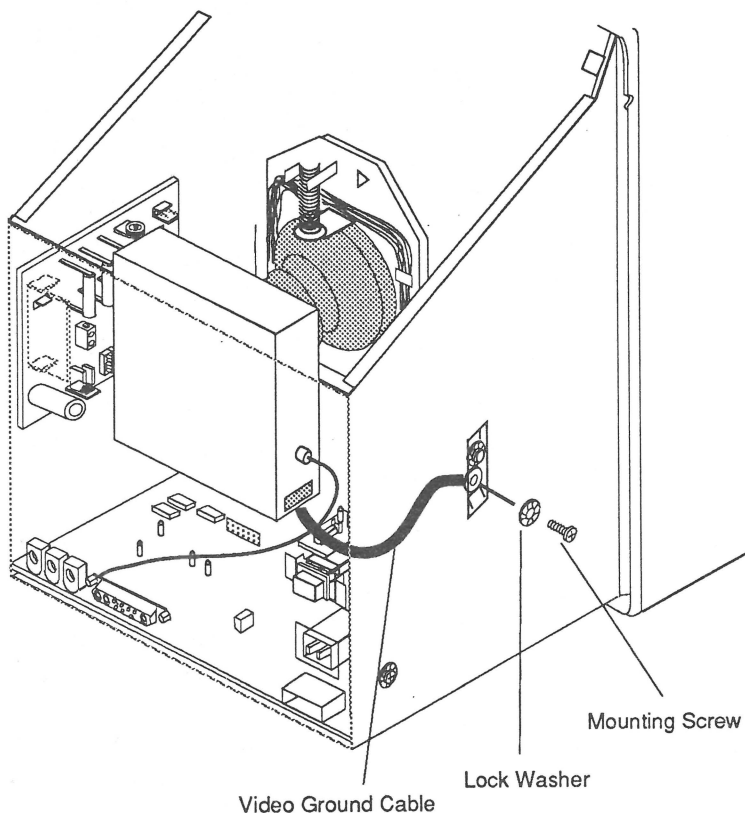


FIGURE 20

5. Disconnect the 4-wire connector from the contrast brightness board (**Figure 21**). Open the two tie wraps to the left of the neck of the CRT.

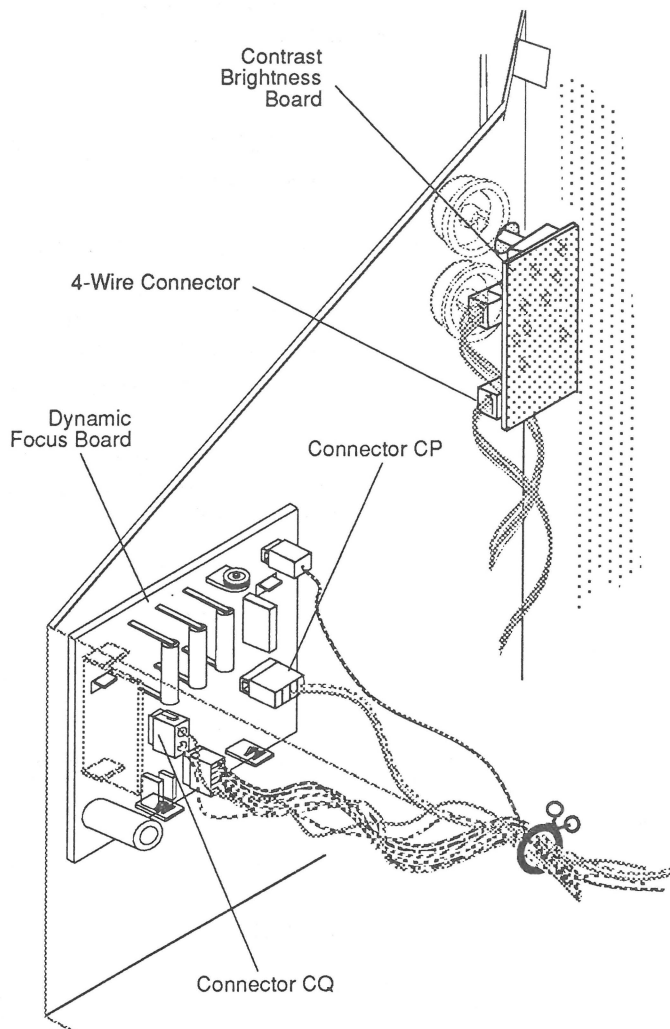


FIGURE 21

6. Disconnect the following connectors from the dynamic focus board (**Figure 21**):

- 2-wire, 4-pin connector (labelled **CP**)
- 2-wire connector (labelled **CQ**)

Note: To disconnect connector **CQ** you must first depress its two plastic release tabs.

7. Disconnect the following connectors from the video board (**Figure 22**):

- Video connector
- 7-wire connector

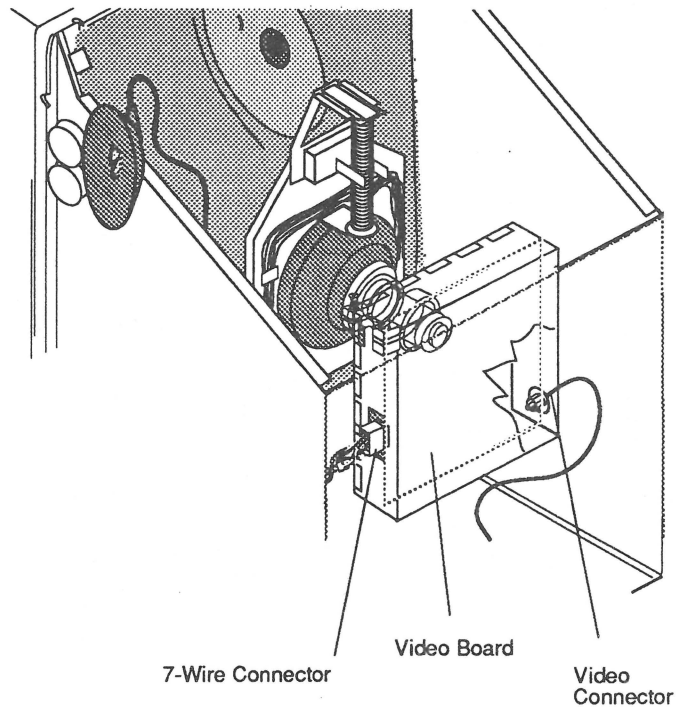


FIGURE 22

8. Carefully place the monitor face down on the protective workbench pad.

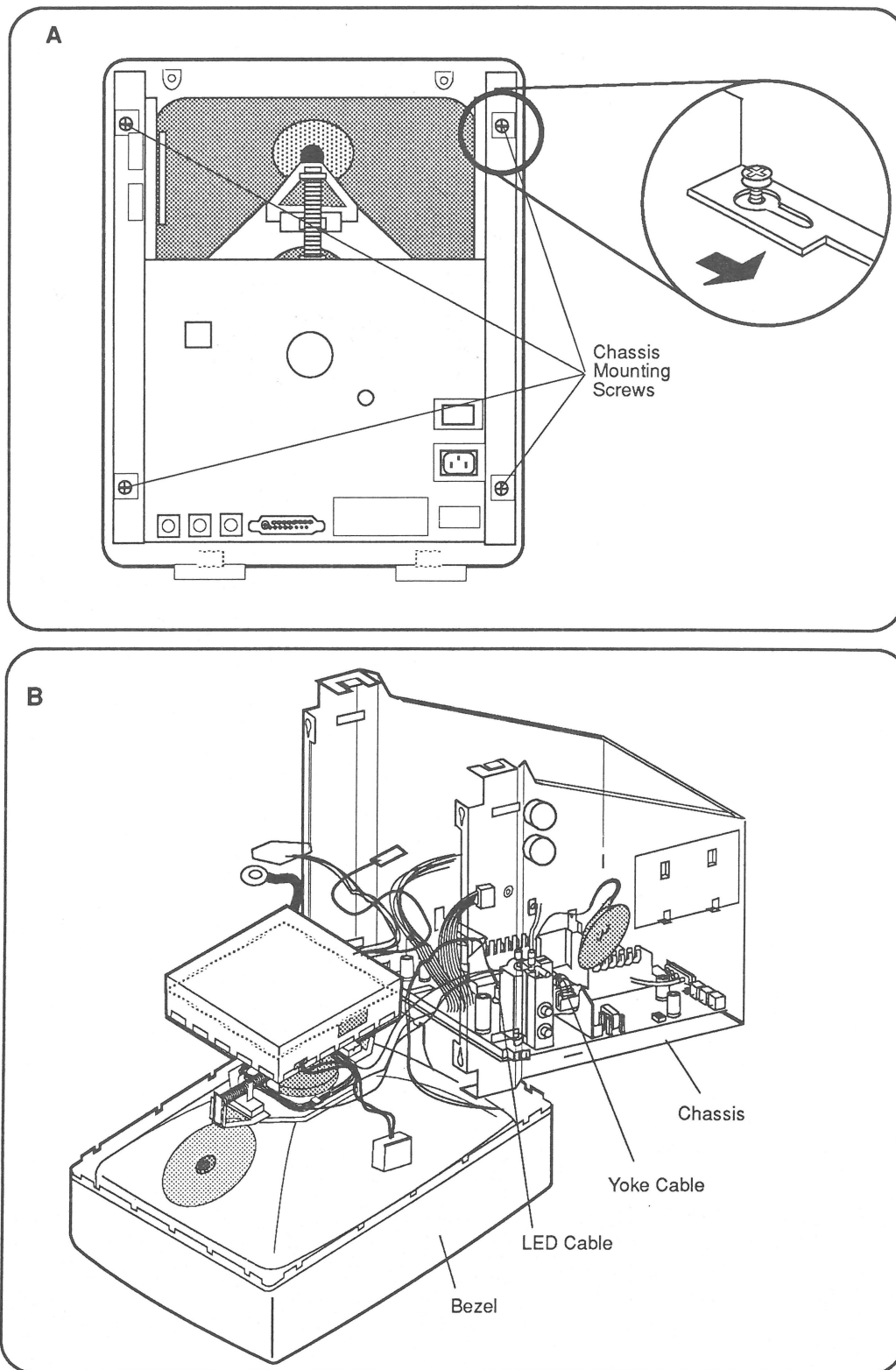


FIGURE 23

CAUTION: When separating the chassis from the bezel, keep in mind that the LED cable and the 4-wire yoke cable are still connected between the chassis and bezel.

9. Separate the chassis and bezel. To do this, refer to **Figure 23** and follow these substeps:
 - a) Loosen (but do not remove) the four chassis mounting screws.
 - b) With the monitor facedown, slide the chassis toward its bottom until the openings in the chassis flanges are aligned with the four screwheads (**Figure 23A**).
 - c) Carefully lift the chassis off the mounting screws and rest it, right side up, on the edge of the bezel as shown in **Figure 23B**. With your right hand, hold the chassis on the bezel.
 - d) With your left hand, disconnect the following connectors from the main deflection board:
 - LED cable (labelled **CN**)
 - 4-wire yoke cable (labelled **CH**)
 - e) Set the chassis aside on the protective pad.

Note: Stop here if you are performing this procedure only to access the main deflection board, the LED assembly, or the bezel.

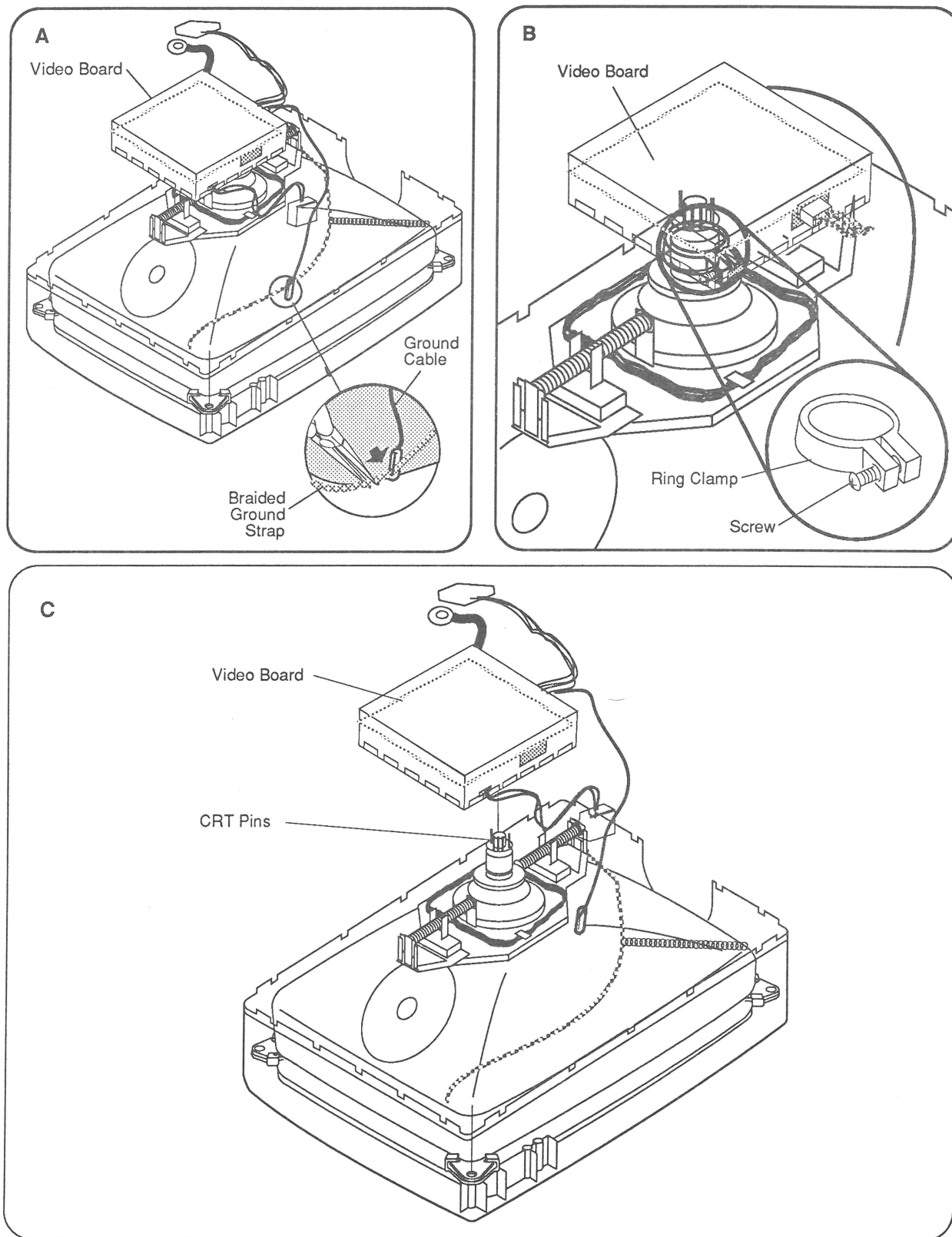


FIGURE 24

10. Disconnect the small black ground cable from the chassis. To do this, pull on the cable and grasp the braided (Aquadag) ground strap with the needlenose pliers. While using the pliers to pull the Aquadag strap away from the CRT with one hand, unhook the ground cable with your other hand (**Figure 24A**).

WARNING: *Twisting, bending, or applying force to the video board could damage the neck of the CRT. Hold the video board squarely on the neck of the CRT with one hand while loosening the ring clamp screw with the other.*

11. Loosen the screw on the plastic ring clamp that secures the video board to the neck of the CRT (**Figure 24B**).
12. Remove the video board from the neck of the CRT (**Figure 24C**). To do this, grab the metal cover with both hands and carefully pull the video board straight back off the CRT.

Replace

1. Install the new video board on the neck of the CRT (**Figure 24C**). To do this, first check that none of the CRT pins is bent; straighten bent pins with a needlenose pliers. Then align the video board connector with the plastic alignment nipple on the neck of the CRT, and firmly push the video board connector onto the neck of the CRT.

WARNING: *Forcing the video board onto the CRT could damage the neck of the CRT. If the video board does not slide easily onto the CRT, slightly adjust the alignment between the video board and the CRT pins and try again. Also do not overtighten the screw on the ring clamp.*

2. Tighten the screw (**Figure 24B**) on the ring clamp just enough to keep the video board from slipping.
3. Reconnect the small black video ground cable to the Aquadag ground strap on the CRT (**Figure 24A**). To do this, first bend open the inner tongue of the metal connector at the end of the video ground cable. Then insert the tip of the jeweler's screwdriver between the braided Aquadag ground strap and the body of the CRT. While prying the Aquadag strap away from the CRT, slip the metal connector on the end of the video ground cable over the Aquadag strap. Bend the tongue back to secure the connector to the Aquadag strap.

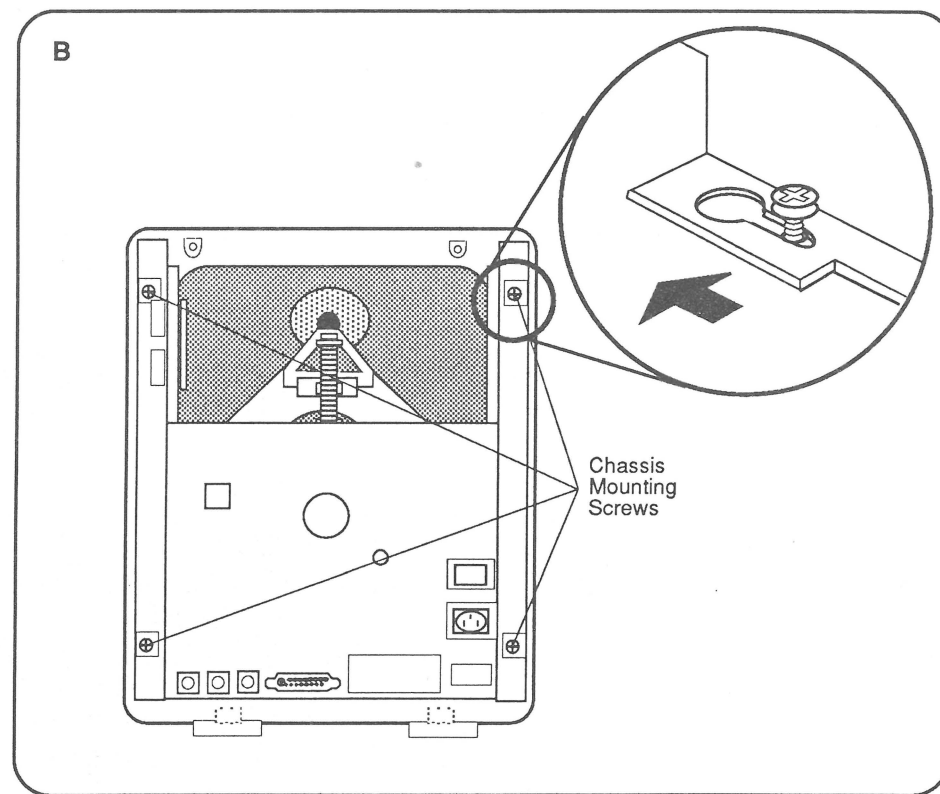
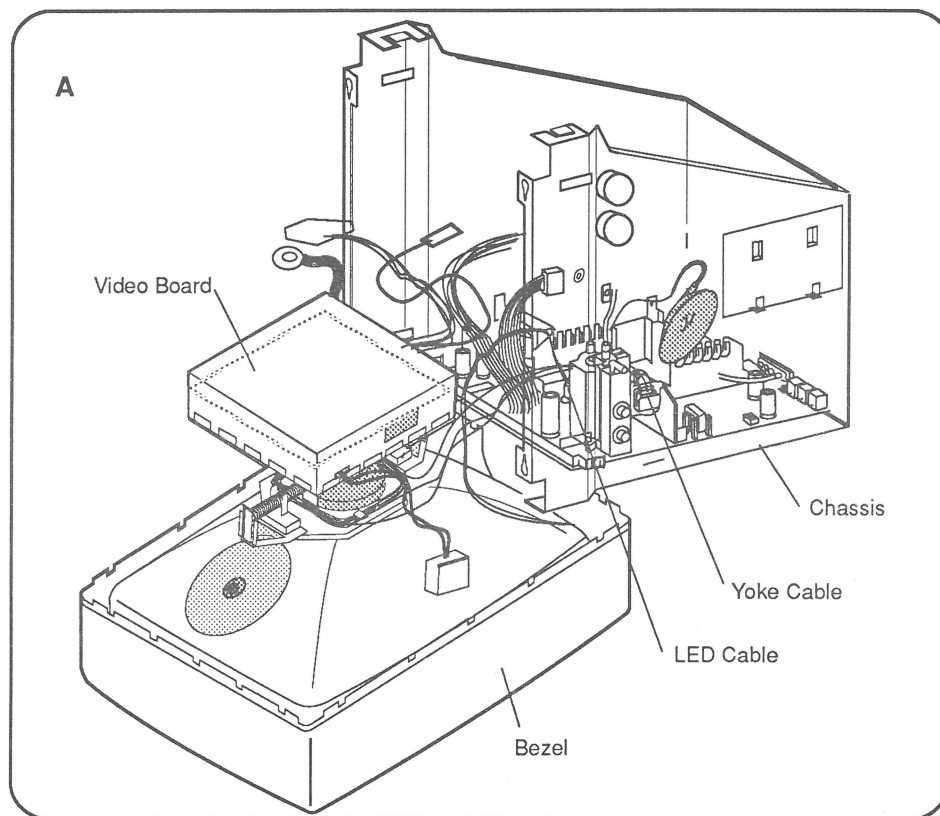


FIGURE 25

4. Replace the chassis on the bezel. To do this, refer to **Figure 25** and follow these substeps:
 - a) Place the chassis right side up on the edge of the bezel as shown in **Figure 25A**. Hold the chassis with your right hand.
 - b) With your left hand, connect the the following connectors to the main deflection board:
 - 4-wire yoke cable (to the connector labelled **CH** on the main deflection board)
 - LED cable (to connector **CN**)
 - c) Tuck all loose cables inside the chassis.
 - d) Carefully place the chassis on the bezel. Slip the four holes in the chassis flange over the four chassis mounting screws, and lock the chassis under the mounting screws as shown in **Figure 25B**.
 - e) Tighten the four chassis mounting screws.
5. Carefully place the monitor upright on the protective workbench pad.

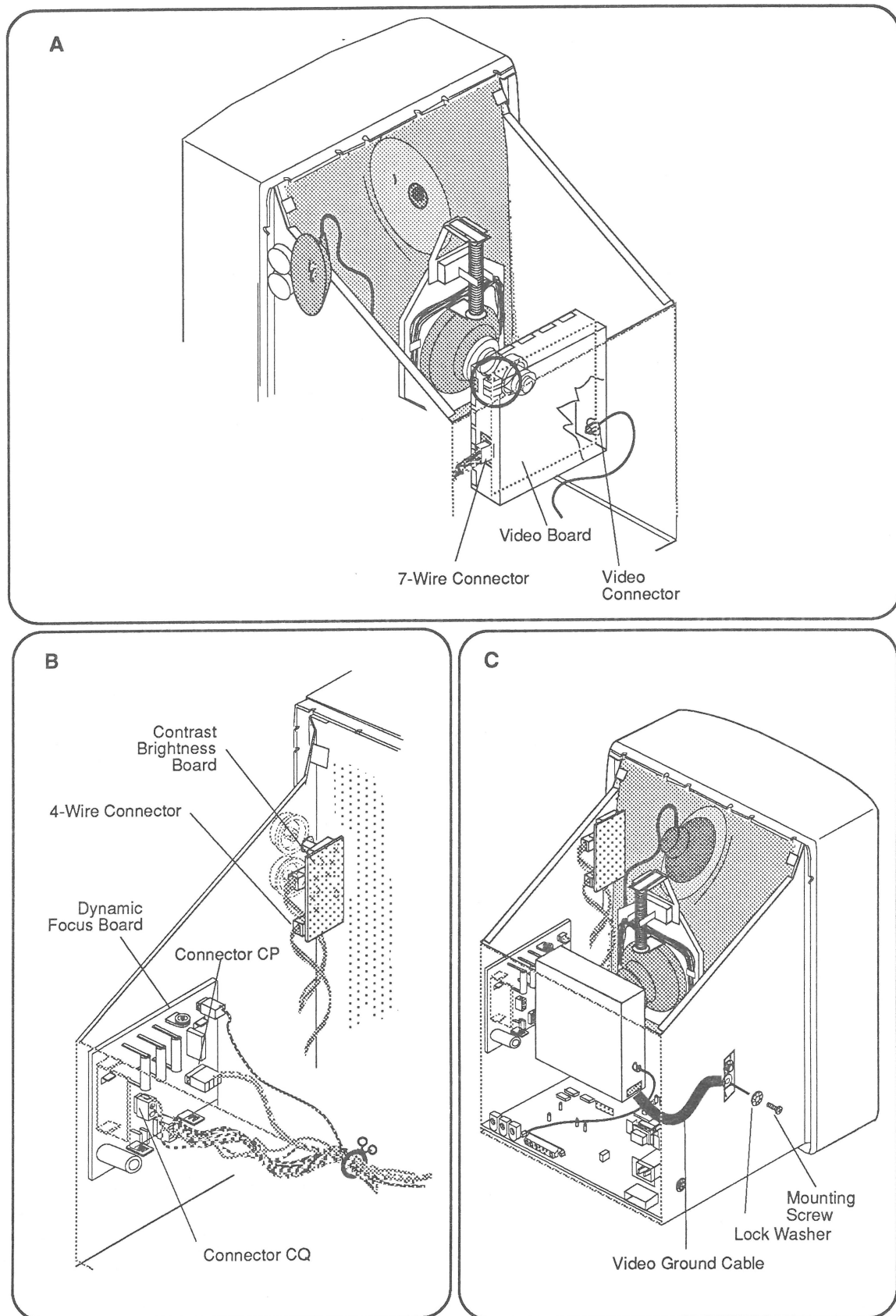


FIGURE 26

6. Reconnect the following connectors to the video board (**Figure 26A**):
 - 7-wire connector
 - Video connector
7. Reconnect the following connectors to the dynamic focus board (**Figure 26B**):
 - 2-wire, 4-pin connector (labelled **CP**)
 - 2-wire connector (labelled **CQ**)
8. Reconnect the 4-wire connector to the contrast brightness board (**Figure 26B**). Rebundle the loose video cables with the two tie wraps.
9. Reconnect the large, black video ground cable to the chassis ground terminal with the lock washer and screw (**Figure 26C**).
10. Replace the bottom and top panels of the EMI shield.
11. Replace the rear cover.

❑ MAIN DEFLECTION BOARD

Materials Required

Small Phillips screwdriver
Medium Phillips screwdriver
3/8-inch nut driver
Small flat-blade screwdriver

Remove

1. Remove the rear cover, and the top and bottom panels of the EMI shield.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad, and put on your grounding wriststrap. (Never put on the grounding wriststrap until after you have discharged the CRT.)
4. Separate the chassis from the bezel. Refer to the video board Remove procedure.
5. Disconnect the on/off switch connector from the connector labelled **CA** on the main deflection board (**Figure 27**).

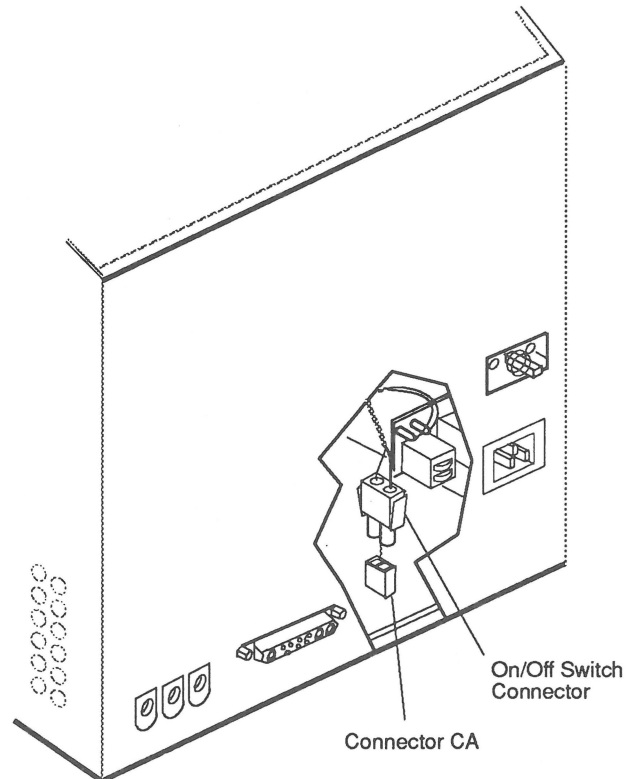


FIGURE 27

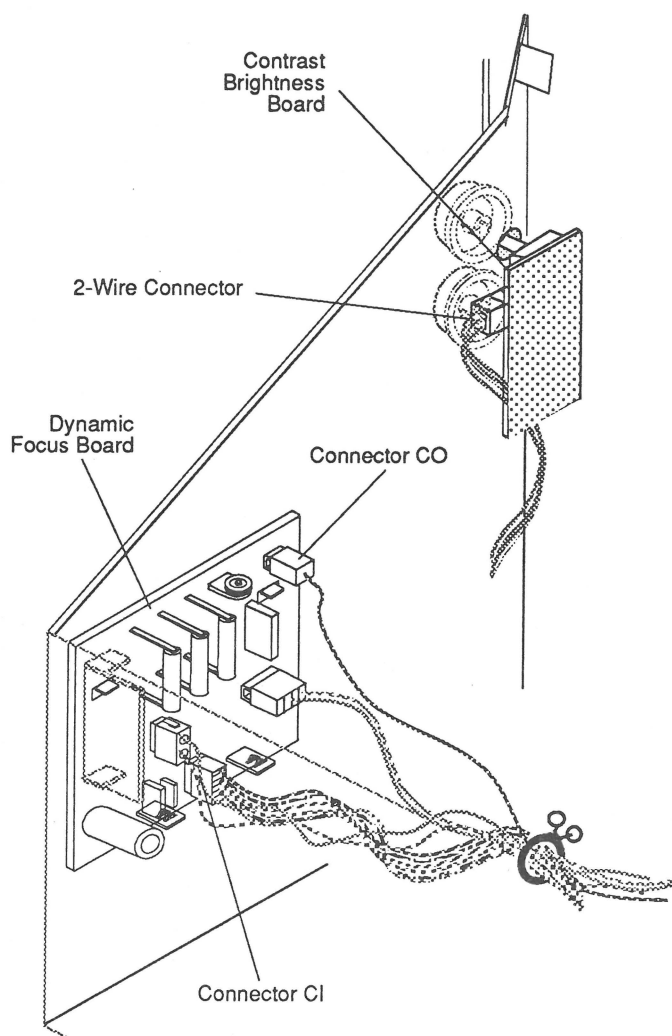


FIGURE 28

6. Disconnect the following connectors from the dynamic focus board (**Figure 28**):
 - Single-wire connector (labelled **CO**)
 - 6-wire connector (labelled **CI**)
7. Disconnect the 3-pin, 2-wire connector from the contrast brightness board (**Figure 28**).

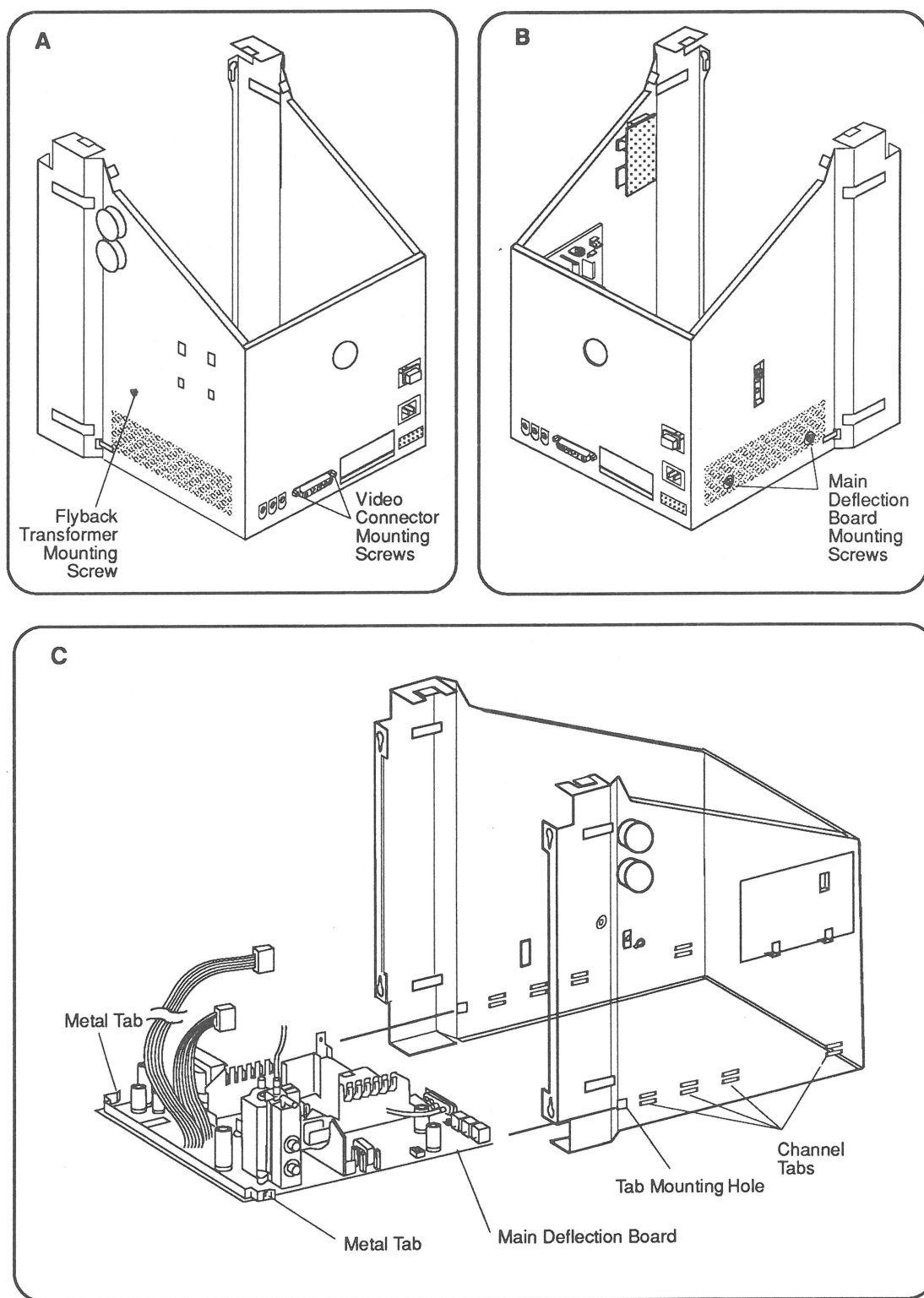


FIGURE 29

8. Remove the screw that secures the flyback transformer to the chassis (**Figure 29A**).
9. Using the 3/16-inch nut driver, remove the two screws that secure the video connector to the chassis (**Figure 29A**).
10. Remove two screws and lock washers that secure the main deflection board to the chassis (**Figure 29B**).
11. Using a flat-blade screwdriver, pry open the two metal tabs and pull the main deflection board out of the chassis (**Figure 29C**).

Replace

1. Replace the main deflection board on the chassis (**Figure 29C**). To do this, fit the board between the channel tabs lining both sides of the chassis. Then push the board forward until the video connector extends through the front of the chassis and the two metal tabs snap onto the chassis.
2. Replace the two screws and lock washers that secure the main deflection board to the chassis (**Figure 29B**).
3. Using the 3/16-inch nut driver, replace the two mounting screws that secure the video connector to the chassis (**Figure 29A**).
4. Replace the screw that secures the flyback transformer to the chassis (**Figure 29A**).

5. Connect the 3-pin, 2-wire connector to the contrast brightness board (**Figure 30**).

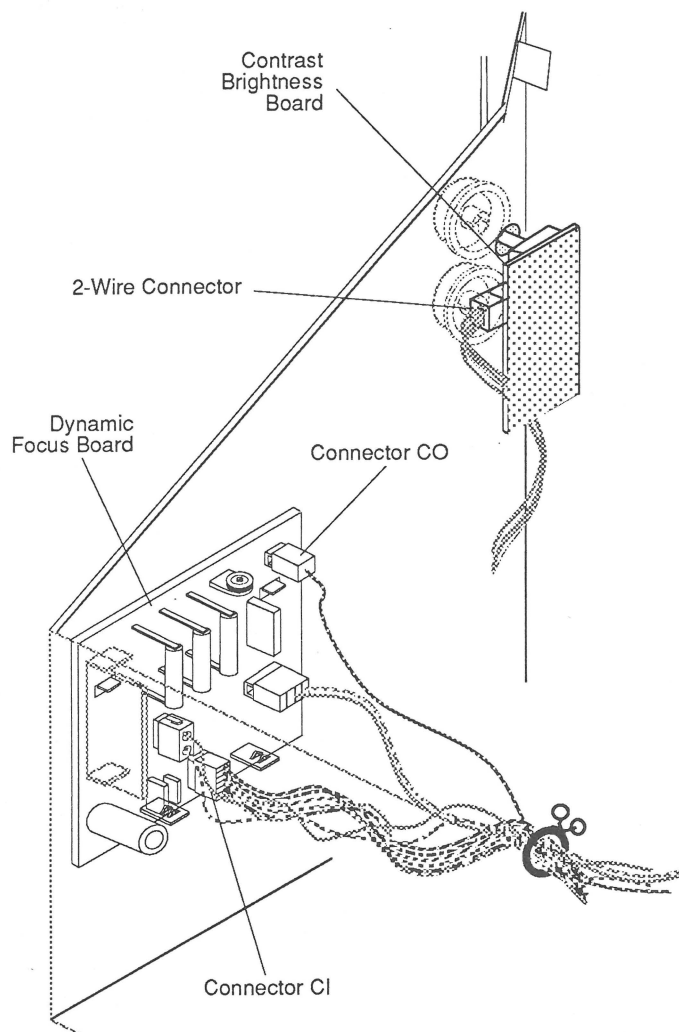


FIGURE 30

6. Connect the following connectors to the dynamic focus board (**Figure 30**):
 - 6-wire connector (to the connector labelled **CI**)
 - Single-wire connector (labelled **CO**)

7. Connect the on/off switch cable to the connector labelled **CA** on the main deflection board (**Figure 31**).

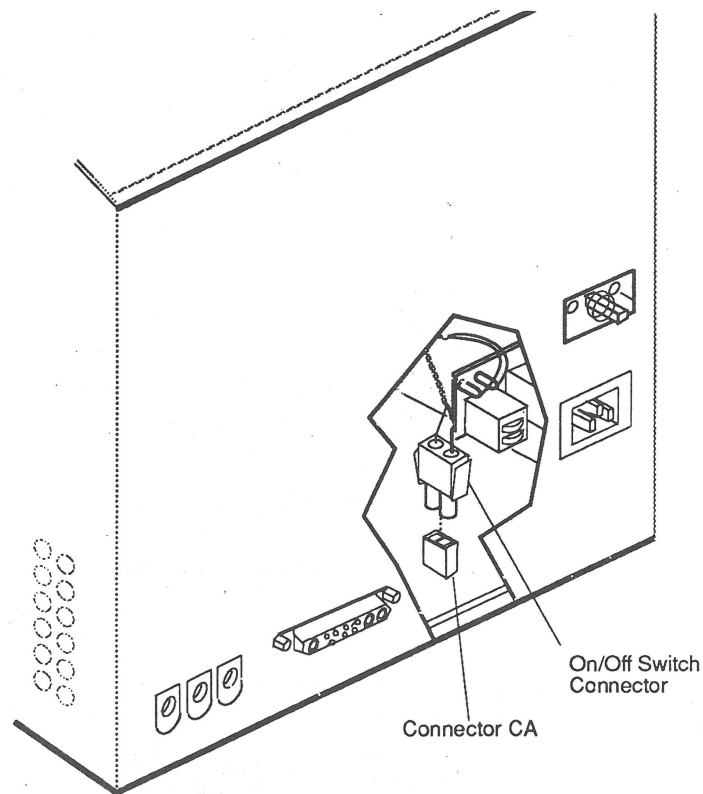


FIGURE 31

8. Replace the chassis. Refer to the video board Replace procedure.
9. Replace the anode cap.
10. Replace the bottom and top panels of the EMI shield.
11. Replace the rear cover.

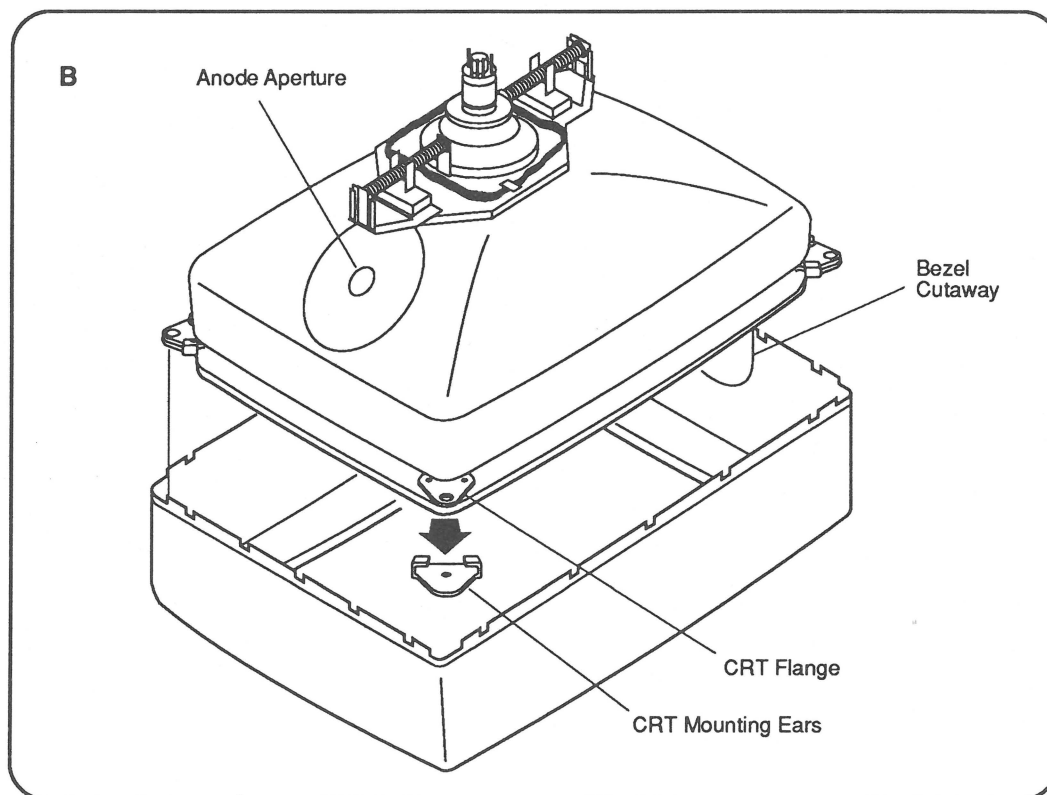
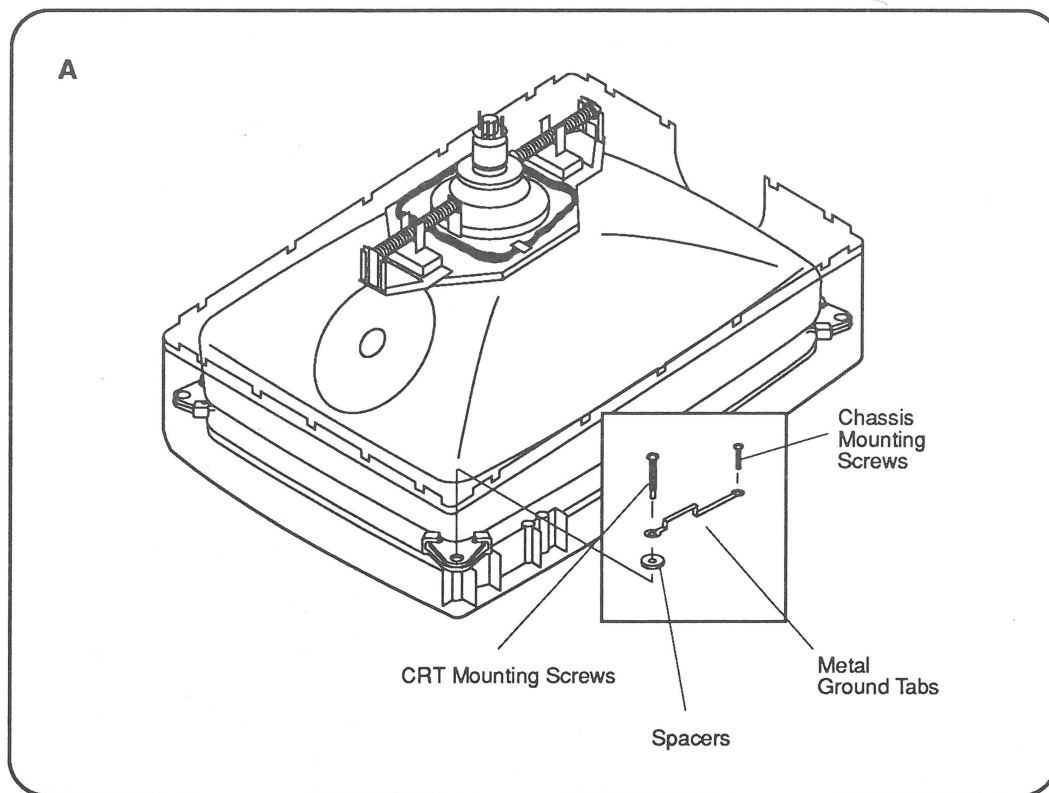


FIGURE 32

□ CATHODE-RAY TUBE (CRT)

Materials Required

Medium Phillips screwdriver (magnetic)

Remove

1. Remove the rear cover and the top and bottom panel of the EMI shield.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad, and put on your grounding wriststrap (put on the wriststrap **only after** discharging the CRT).
4. Remove the video board.
5. Remove the four chassis mounting screws (**Figure 32A**).
6. Remove the four CRT mounting screws, metal ground tabs, and spacers from the corners of the bezel (**Figure 32A**).

CAUTION: *The neck of the CRT is easily damaged. Do not grab the neck of the CRT to remove it from the bezel. If necessary, have a helper hold down the bezel while you grab the CRT by its edges and remove it.*

7. Lift the CRT out of the bezel. Remove the four CRT mounting ears from the flanged corners of the CRT (**Figure 32B**).

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the You Oughta Know tab.*

Replace

1. Place the four CRT mounting ears on the corner flanges of the CRT, and carefully place the CRT inside the bezel as shown in **Figure 32B**. The anode aperture in the CRT should be on the opposite end of the cutaway in the bezel.
2. Install the four spacers, metal grounding tabs, and chassis mounting screws on the corners of the CRT (**Figure 32A**). Tighten the chassis mounting screws to 1/4 inch above the grounding tabs.

3. Align the mounting ears, flanges, spacers, and tabs with the mounting holes in the bezel, and replace the four CRT mounting screws (**Figure 32A**). **Make sure the CRT is positioned in the approximate center of the bezel before tightening the CRT mounting screws.**
4. Replace the video board.
5. Replace the anode cap, and the bottom and top panels of the EMI shield.
6. Replace the rear cover.

□ LED CABLE ASSEMBLY

Materials Required

Small Phillips screwdriver

Remove

1. Remove the rear cover and the top and bottom panel of the EMI shield.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor upright on a grounded workbench pad, and put on your grounding wriststrap. (Never put on the grounding wriststrap until after you have discharged the CRT.)
4. Remove the video board.
5. Remove the CRT.
6. Remove the mounting screw, and slide the LED cable assembly out of the bezel (**Figure 33**).

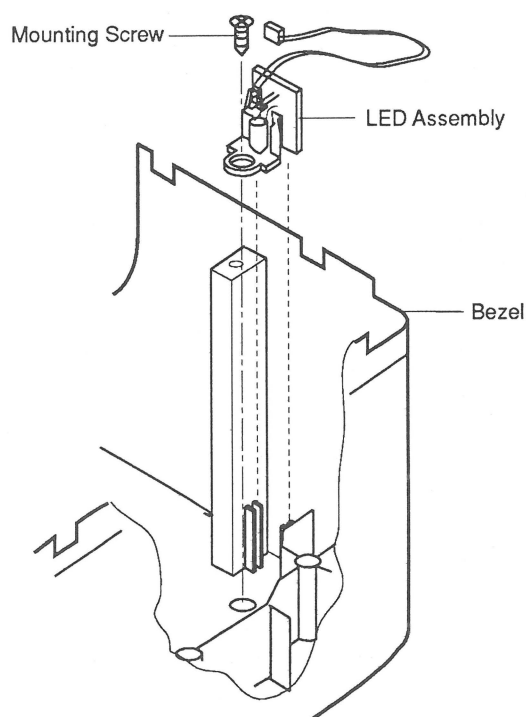


FIGURE 33

Replace

1. Slide the LED cable assembly onto the bezel as shown in **Figure 33**, and replace the mounting screw.
2. Replace the CRT and the main deflection board.
3. Replace the video board.
4. Replace the anode cap.
5. Replace the bottom and top panels of the EMI shield, and the rear cover.

□ BEZEL

Remove

1. Remove the rear cover.
2. Replace the top and bottom panels of the EMI shield.
3. Discharge the CRT and remove the anode cap.
4. Place the monitor upright on a grounded workbench pad, and put on your grounding wriststrap. (Never put on the grounding wriststrap until after you have discharged the CRT.)
5. Separate the chassis from the bezel. Refer to the video board Remove procedure.
6. Remove the CRT.
7. Remove the LED cable assembly.

Replace

1. Replace the LED cable assembly.
2. Replace the CRT.
3. Replace chassis. Refer to the video board Replace procedure.
4. Replace the anode cap.
5. Replace the bottom and top panels of the EMI shield.
6. Replace the rear cover.

Apple Macintosh Portrait Display “Series B”

Section 3 – Adjustments

□ CONTENTS

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3.3	Safety Instructions
3.4	Live Adjustment Rules
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3.5	External Service Controls
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3.8	MacTest II/IIx Materials Required
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3.13	Adjustment Procedures
3.13	Materials Required
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3.15	Horizontal Adjustments
3.18	Focus
3.19	Video Adjustments

□ INTRODUCTION

Whenever you replace a module within the Apple Macintosh Portrait Display "Series B," some adjustment of the video display may be necessary. As a general rule, replacing the main deflection board may require making geometric (vertical/horizontal) or focus adjustments, whereas replacing the CRT or video board requires performing the video adjustments.

IMPORTANT: *Do not attempt any tilt or ring adjustments on the yoke of the Macintosh Portrait Display. All such yoke adjustments have been set by the manufacturer.*

Use the following procedures to perform horizontal, vertical, focus, and video adjustments. If these procedures do not correct the monitor's adjustment problems, isolate the faulty module (see Section 4, Troubleshooting) and return the module to Apple.

□ SAFETY INSTRUCTIONS

WARNING: *The Macintosh Portrait Display contains a high-vacuum picture tube and operates at very high voltages. To prevent serious injury, before working inside this monitor, read and learn all safety precautions in Section 8, CRT Safety, under the You Oughta Know tab.*

In addition to the safety precautions outlined in CRT Safety under the You Oughta Know tab, be sure to:

- Use only insulated alignment tools whenever performing live video adjustments on the monitor.
- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with your other hand.
- Use a mirror for viewing adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to the back of the monitor to rotate the controls—you cannot see what you are about to touch!
- Perform only those adjustments that are absolutely necessary. Do not attempt to make any adjustments other than the ones explained in this section, and do those with extreme caution.

WARNING: Serious injury could result if, with the power on, you touch any of the components shown in **Figure 1**.

Live Adjustment Rules

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Macintosh Portrait Display (Figure 1).

- Any part of the yoke assembly, including the yoke wires
- The anode wire
- The anode connector
- The flyback transformer
- The inside of the AC power switch
- The high-voltage resistors (R517, R518, R520) on the dynamic focus board

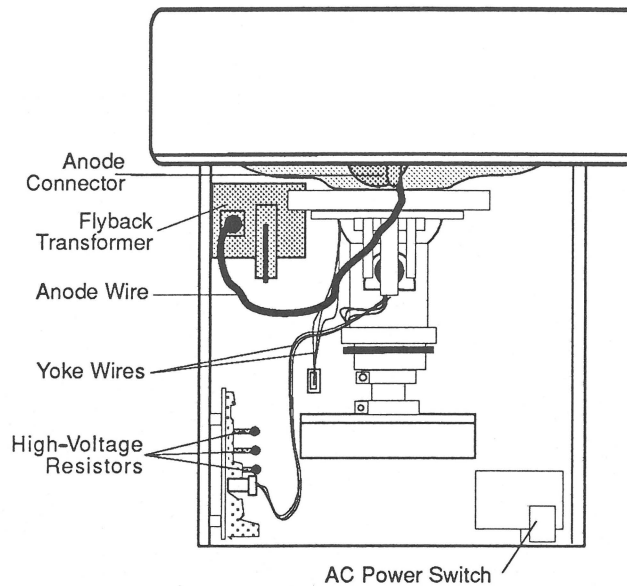


FIGURE 1

□ LOCATION OF CONTROLS

User Controls

The brightness and contrast controls are located on the side of the monitor's case and are accessible to the user (**Figure 2**).

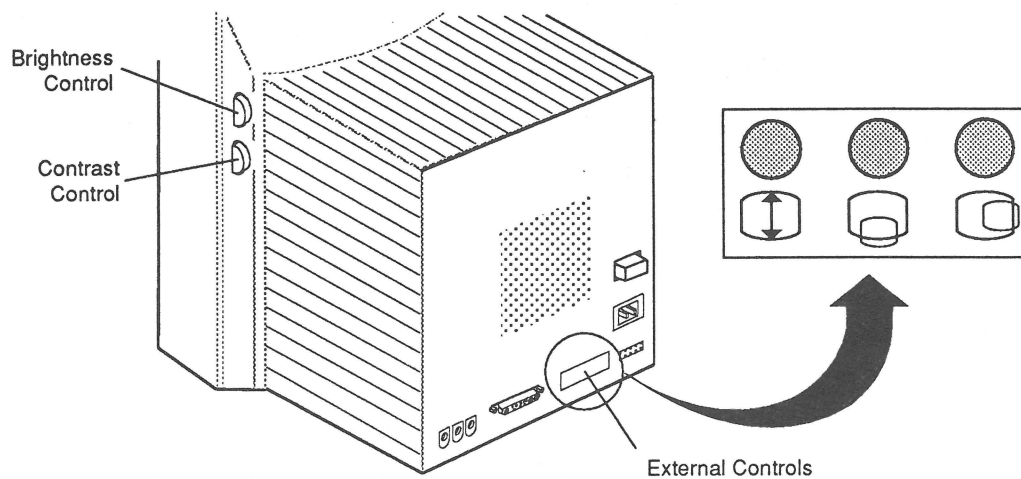


FIGURE 2

External Service Controls

The following service adjustment controls are located on the main deflection board, but can be accessed by removing a plastic panel found on the rear cover (**Figure 2**).

- Height, or vertical amplitude (V.AMP; RV5)
- Vertical center (V.SHIFT; RV4)
- Horizontal center (H.PHASE; RV7)

Internal Service Controls

The internal service adjustment controls are located on the video board, the dynamic focus board, and the main deflection board. These controls can be accessed only after removing the rear cover.

Video board (Figure 3)

- VIDEO GAIN

Dynamic focus board (Figure 3)

- FOCUS (RV502)
- DYNAMIC FOCUS (RV501)

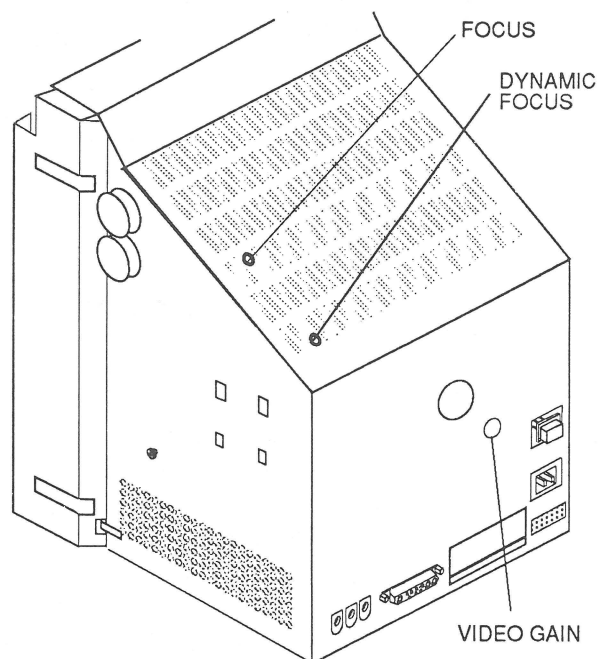


FIGURE 3

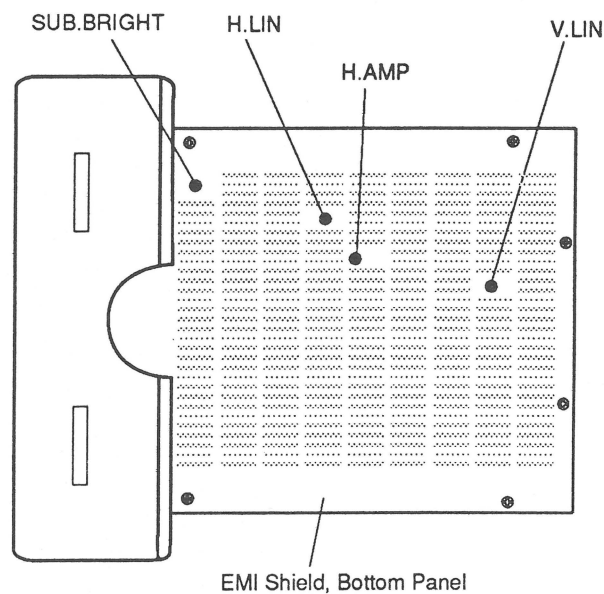


FIGURE 4

Note: Internal service controls located on the main deflection board are accessed through the bottom panel of the EMI shield.

Main deflection board (Figure 4)

- V.LIN (RV3)
- H.AMP (B5))
- H.LIN (B6))
- SUB.BRIGHT (RV9)

□ TEST PATTERNS

Procedures for using the *MacTest* diagnostic program to display test patterns on a Portrait Display differ, depending upon whether the monitor is connected to a Macintosh II/Ix or to a Macintosh IICx/IIfx. Use the version of *MacTest* that is appropriate for your test station.


MacTest II/Ix Materials Required

Macintosh II or Macintosh IIfx
Macintosh II Portrait Video Card or Macintosh Display Card
MacTest™II/Ix diagnostic disk (version 3.1 or higher)

IMPORTANT: *The Macintosh II Portrait Video Card RAM must be upgraded to 512K in order to display the MacTest (II/Ix or IICx/IIfx) test patterns. Refer to the Macintosh Family Cards Technical Procedures.*

Generating Test Patterns Using MacTest II/Ix

MacTest II/Ix tests the video RAM on the Macintosh II Portrait Video Card and displays test patterns used to adjust the monitor. Follow the steps below to display the *MacTest II/Ix* test patterns:

1. Connect the monitor's video cable and power cord to the Macintosh II or Macintosh IIfx computer.
2. Boot the *MacTest II/Ix* disk. For computers with more than one drive, boot *MacTest* from Drive 1, the right-side drive.
3. *MacTest II/Ix* will display a window instructing you to turn off the system and connect a SCSI loopback card. Unless you wish to test the logic board, click **OK** to get to the Start window.
4. When the Start window appears on the screen, go to the  menu and open the Control Panel.
5. Click the Monitors icon.
6. In the area called **Characteristics of selected monitor**, select **Black & White/Grays**. In the area called **Grays**, select the number **16**.

7. If more than one monitor is connected to the computer, make sure the Macintosh Portrait Display is the main monitor. (Test patterns can be displayed on the main monitor only.) Check the box at the bottom of the panel—the monitor icon with a menu bar is the main monitor. If necessary, drag the menu bar to the icon representing the Portrait Display.
8. Close the Control Panel to return to the Start window.

Note: If you selected a new main monitor, you must restart *MacTest II/IIx* in order for this change to take effect. After closing the Control Panel, quit *MacTest II/IIx* and then reboot *MacTest II/IIx*.

9. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect the default Logic and Disk Drives tests by clicking their selection boxes once.
10. To test video RAM on the video card, click **Video Card in slot**. Apple recommends testing the video card before performing the video adjustments.
11. Click **Video monitor** to display the video adjustment test patterns, and click **OK** to close the Test Selections window.
12. When the Start window reappears, click **Start**.

Note: If you selected the video card RAM test, this message appears: **Testing Macintosh Video Card**. Horizontal and vertical lines flash across the screen. After about one minute the Start window reappears, and the Status line indicates whether the video card passed the test.

13. An alert box informs you that test patterns can be displayed only on the default monitor. Click **OK** to display the first test pattern.

Note: Click the mouse to advance to the test pattern you want. Each test pattern is displayed once. When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** reruns the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in slot** in the Test Selections window.)

14. *MacTest II/Ix* displays the test patterns listed below and shown in Figure 5.

- Gray Bars
- Full Black Screen
- Full White Screen
- Crosshatch I (black background)
- Crosshatch II (white background)
- Focus

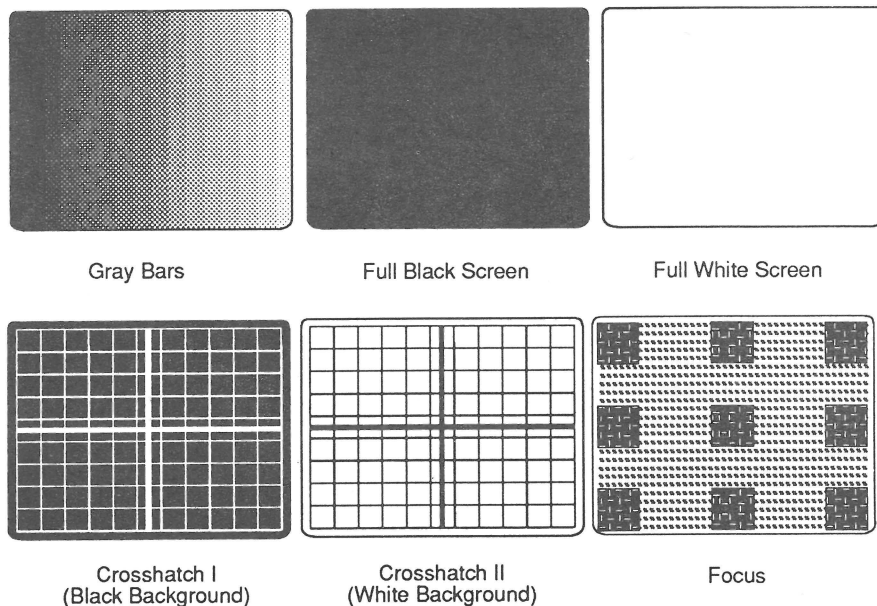


FIGURE 5

MacTest IIcx/IIci Materials Required

Macintosh IIcx or Macintosh IIci
Macintosh II Portrait Video Card or Macintosh Display
Card (not required for Macintosh IIci)
MacTest™ IIcx/IIci diagnostic disk (version 2.0 or
higher)

IMPORTANT: *The Macintosh II Portrait Video Card RAM must be upgraded to 512K in order to display the MacTest IIcx/IIci test patterns. Refer to the Macintosh Family Cards Technical Procedures.*

Generating Test Patterns Using MacTest IIcx/IIci

MacTest IIcx/IIci tests the video RAM on video cards installed in Macintosh IIcx or IIci computers and displays test patterns used to adjust the monitor. Follow the steps below to test the video RAM or display the test patterns.

1. Connect the monitor's video cable and power cord to the Macintosh IIcx or Macintosh IIci computer.
2. Boot the *MacTest IIcx/IIci* disk.
3. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect all default test selections.

Note: Apple recommends testing the video RAM before performing the video adjustments. To test video RAM on board a Macintosh IIci computer, you must run the **Short** or **Long RAM** logic test.

4. To test the video RAM on an installed video card, click **Video Card in Slot** and enter the appropriate slot number.
5. To display the video adjustment test patterns:
 - Click **Video Monitor Connected to Built-in Video**, or
 - Click **Video Monitor Connected to Selected Card**. (Be sure that the correct video card slot is entered in the Video Card in Slot box.)

6. Click **OK** to close the Test Selections window and return to the Start window.

Note: If built-in video is being used to generate the monitor test patterns, the memory allocation for the built-in video must be set to at least 16 grays/colors. From the Apple menu, open the Control Panel, click **Monitors**, click the highest number of Grays/Colors, and close the Control Panel.

7. From the Start window, click **Start** to proceed. You will encounter one or both of these scenarios:

- If you chose to test the Portrait Video Card, the following message appears on the main (boot) monitor: **Testing Macintosh II Portrait Video Card**. Horizontal and vertical lines flash across the screen of the Portrait Display. After about one minute, the Status line in the Start window on the main monitor indicates whether the video card passed the test. Clicking **Start** again displays the first test pattern (if selected) or reruns the video card test.
- If you chose to display only the monitor test patterns, the first (gray bars) test pattern is displayed on the Portrait Display screen. Click the mouse to advance through the test patterns (each test pattern is displayed once). When you have advanced through the test patterns, you are returned to the Start window. Clicking **Start** reruns the video RAM test (if selected), and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)

8. *MacTest IIcx/IIci* displays the test patterns listed below:

- Gray Bars
- Full White Screen
- Full Black Screen
- Crosshatch I (black background)
- Crosshatch II (white background)
- Focus

□ ADJUSTMENT PROCEDURES

The vertical size, vertical center, and horizontal center adjustments can be performed using the external service controls only. All other service adjustments are performed with the rear cover removed.

WARNING: Always use an insulated screwdriver when performing live video adjustments. For the following procedures, also make sure the insulated screwdriver has a plastic tip.

Materials Required

Plastic adjustment tool (insulated plastic screwdriver)
Plastic hex alignment tool
Voltmeter
Light meter (Sekonic Multi-Lumi, model L-248)
Mirror and flexible metric ruler

Vertical Adjustments

The vertical size and vertical center adjustments use the Full White Screen test pattern; the vertical linearity adjustment uses a Crosshatch test pattern. To display these patterns, see "Test Patterns."

Adjusting Vertical Size

1. Display the Full White Screen test pattern on the monitor (see "Test Patterns").
2. Using the insulated plastic screwdriver, turn the height, or vertical amplitude (V.AMP) control (**Figure 6**) until the raster is 276 mm high.

Note: To measure the raster height, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the top edge of the raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the bottom of the raster, and note the ruler measurement.

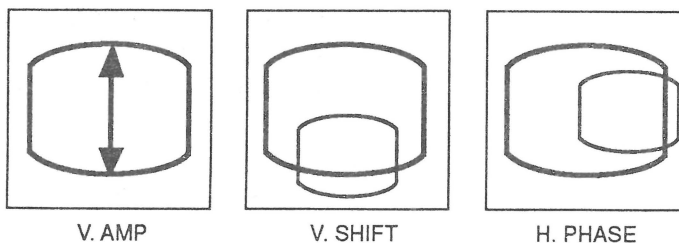


FIGURE 6

Adjusting Vertical Center

1. Display the Full White Screen test pattern on the monitor (see "Test Patterns").
2. Using the insulated plastic screwdriver, turn the vertical center (V.SHIFT) control (**Figure 7**) until the raster is centered (top to bottom) in the display area.
3. Verify that the raster is 276 mm high. If it is not, perform the vertical size adjustment and (if necessary) repeat the vertical center adjustment.

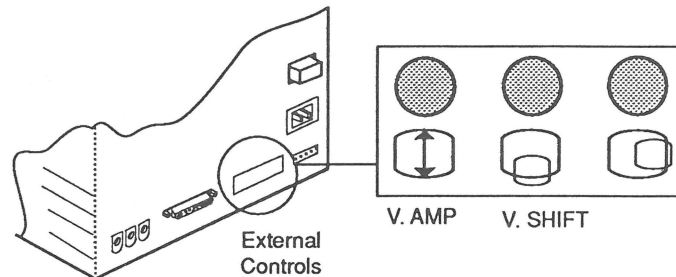


FIGURE 7

Adjusting Vertical Linearity

1. Turn off power to the test station and to the monitor, and disconnect all cables from the monitor.
2. Remove the rear cover.
3. Reconnect the power and video cables to the monitor, and turn on monitor and system power.
4. Display either Crosshatch test pattern on the monitor (see "Test Patterns").
5. Place the monitor on its side, with the bottom facing you. Use the mirror to view the screen display.
6. Using the insulated plastic screwdriver, turn the vertical linearity (V.LIN) control (**Figure 8**) until the boxes at the top of the display are the same size as those at the bottom. (With the monitor on its side, keep in mind that the top and bottom of the display are on your left and right.)
7. Recheck and (if necessary) repeat the vertical center and vertical size adjustments.

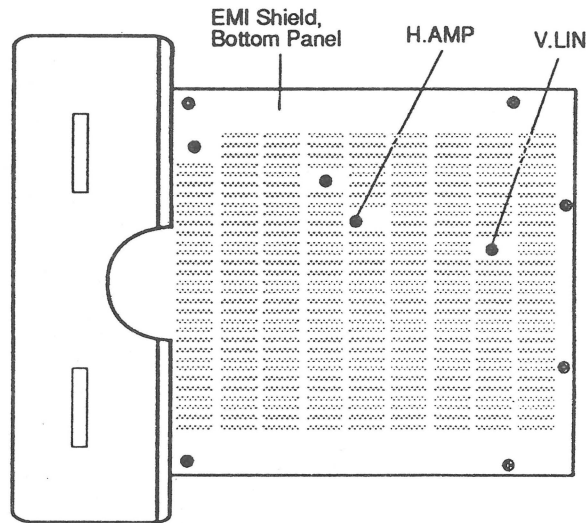


FIGURE 8

Horizontal Adjustments

The horizontal adjustments use the Full White Screen test pattern. To display this pattern, see "Test Patterns."

Adjusting Horizontal Size

1. Turn off power to the test station and to the monitor, and disconnect all cables from the monitor.
2. Remove the rear cover.
3. Reconnect the power and video cables to the monitor, and turn on monitor and system power.
4. Using the insulated plastic screwdriver, turn the horizontal size (H.AMP) control (**Figure 8**) until the raster is 203 mm wide.

Note: On some monitors you may need to remove the bottom panel of the EMI shield to adjust the H.AMP control (see the Take-Apart procedure). If the H.AMP control is too difficult to adjust using a plastic tool, try using the Apple alignment tool with metal tip (P/N 949-0223).

Note: To measure the raster width, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the left edge of the raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the right edge of the raster, and note the ruler measurement. Adjust the H.AMP control as necessary.

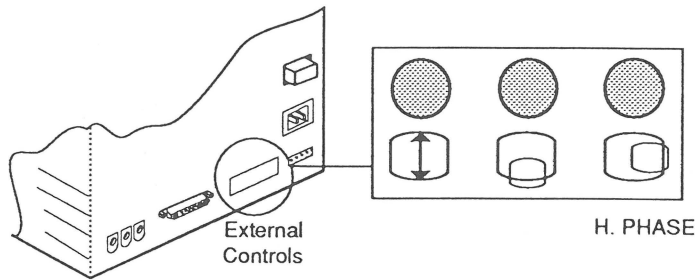


FIGURE 9

Adjusting Horizontal Center

1. Using the insulated plastic screwdriver, turn the horizontal center (H.PHASE) control (**Figure 9**) until the raster is centered (left to right) in the display area.
2. Verify that the raster is 203 mm wide. If it is not, perform the horizontal size adjustment and repeat (if necessary) the horizontal center adjustment.

Adjusting Horizontal Linearity

1. Turn off power to the test station and to the monitor, and disconnect all cables from the monitor.
2. Remove the rear cover.
3. Reconnect the power and video cables to the monitor, and turn on monitor and system power.
4. Display either Crosshatch test pattern on the monitor (see "Test Patterns").
5. Place the monitor on its side, with the bottom facing you. Use the mirror to view the screen display.

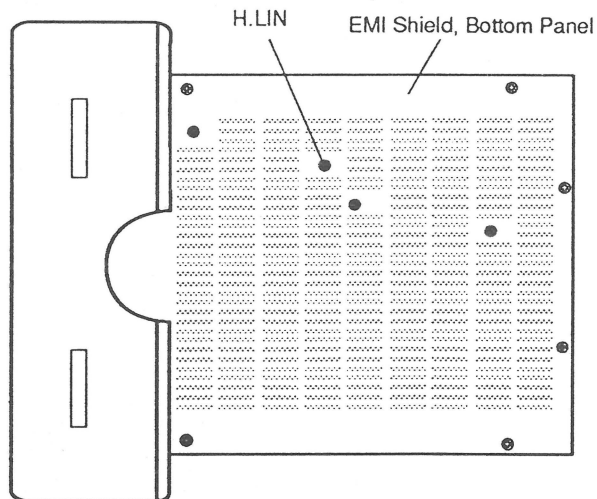


FIGURE 10

6. Using the hex alignment tool, turn the horizontal linearity (H.LIN) control (**Figure 10**) until the boxes at the left of the display are the same size as those at the right. (With the monitor on its side, keep in mind that the left and right sides of the display are on the top and bottom.)
7. Recheck and (if necessary) repeat the horizontal center and horizontal size adjustments.

Focus

1. Turn off power to the test station and to the monitor, and disconnect all cables from the monitor.
2. Remove the rear cover.
3. Reconnect the power and video cables to the monitor, and turn on monitor and system power.
4. Display the Focus test pattern on the monitor (see "Test Patterns").
5. Set the brightness control (**Figure 11**) to midrange—the detent position. To identify the detent position, turn the knob and locate the place in the middle where the knob hesitates.
6. Set the contrast control (**Figure 11**) at maximum (full clockwise).

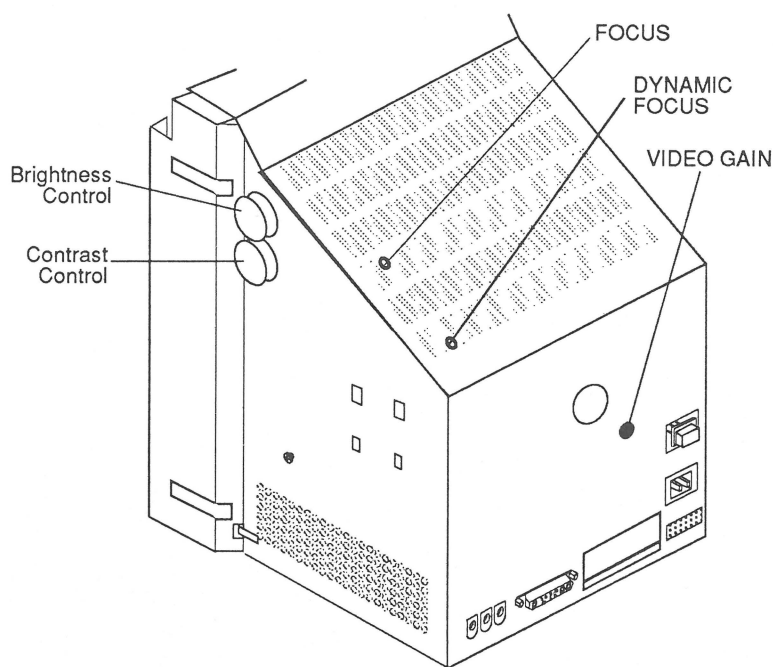


FIGURE 11

Note: On some monitors you may need to remove the top panel of the EMI shield to adjust the focus control. Refer to the Take-Apart procedure.

WARNING: To prevent serious injury, do not touch the three high-voltage resistors on the dynamic focus board. These resistors are labelled R517, R518, and R520.

7. Using the insulated plastic screwdriver, successively adjust the following focus controls (**Figure 11**):
 - a) Turn the focus control to attain the best possible overall focus.
 - b) Turn the dynamic focus control to attain the best possible focus along the left and right edges of the display.
 - c) Repeat substeps a and b until you have attained the best focus possible.

Video Adjustments

The video adjustments should be performed whenever the CRT or video board has been replaced.

1. Turn off power to the test station and to the monitor, and disconnect all cables from the monitor.
2. Remove the rear cover.
3. Reconnect the power and video cables to the monitor, and turn on monitor and system power.
4. Display the Gray Bars test pattern on the monitor (see "Test Patterns").
5. Set the brightness control (**Figure 11**) to midrange—the detent position. To identify the detent position, turn the knob and locate the place in the middle where the knob hesitates.
6. Set the contrast control (**Figure 11**) at maximum (full clockwise).

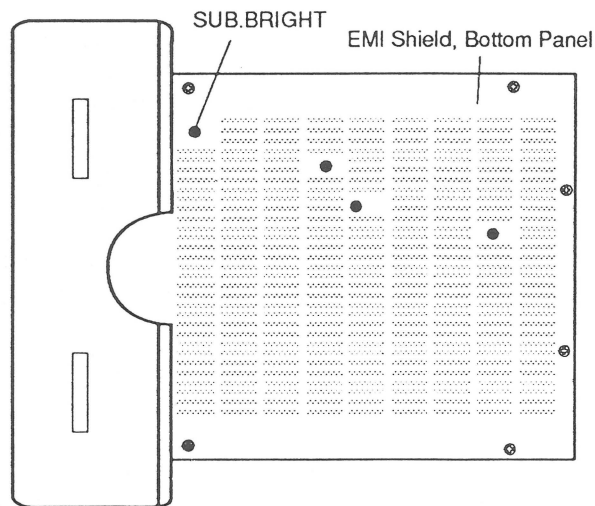


FIGURE 12

7. Place the monitor on its side, with the bottom facing you. Use the mirror to view the screen display.
8. Using the insulated plastic screwdriver, turn the SUB.BRIGHT control (**Figure 12**) until the first bar (on bottom) is completely black, and the second bar is barely visible. The first bar should match the black border that extends 1/8 inch around the screen.
9. Place the monitor upright, and display the Full White Screen test pattern on the monitor (see "Test Patterns").
10. Make sure the brightness control is still set at its detent position and the contrast control is at maximum (full clockwise).

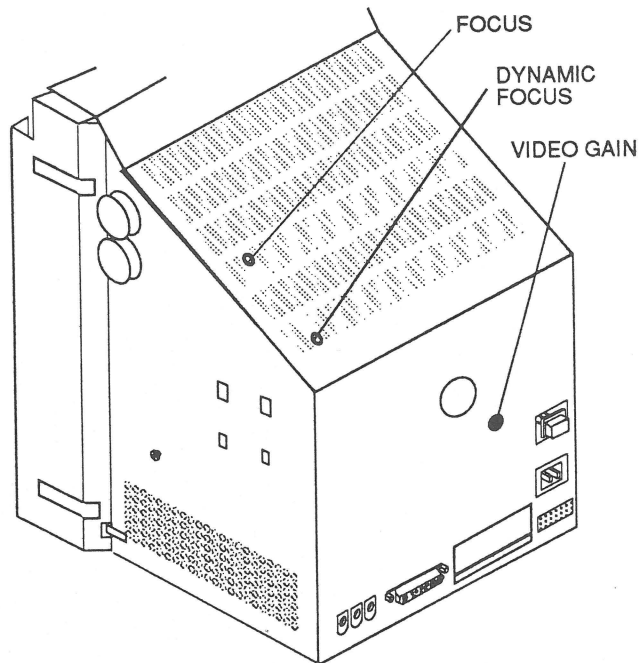


FIGURE 13

11. Measure screen luminance with the light meter. The light meter should read at the low end of the 11 scale (40 ft.-lamberts) (**see Figure 14**).

If screen luminance is too high or low, use the insulated screwdriver to turn the video gain control (**Figure 13**) until you obtain a correct reading at the light meter. (See "Using the Light Meter to Measure Screen Luminance" later in this section for more information.)

12. Set the brightness control at maximum (full clockwise), and recheck screen luminance with the light meter. The light meter should not measure beyond the 11 scale (above 60 ft.-lamberts) (**see Figure 14**).

If screen luminance measures out of the 11 scale (over 60 ft.-lamberts) on the light meter, repeat the video adjustments procedure.

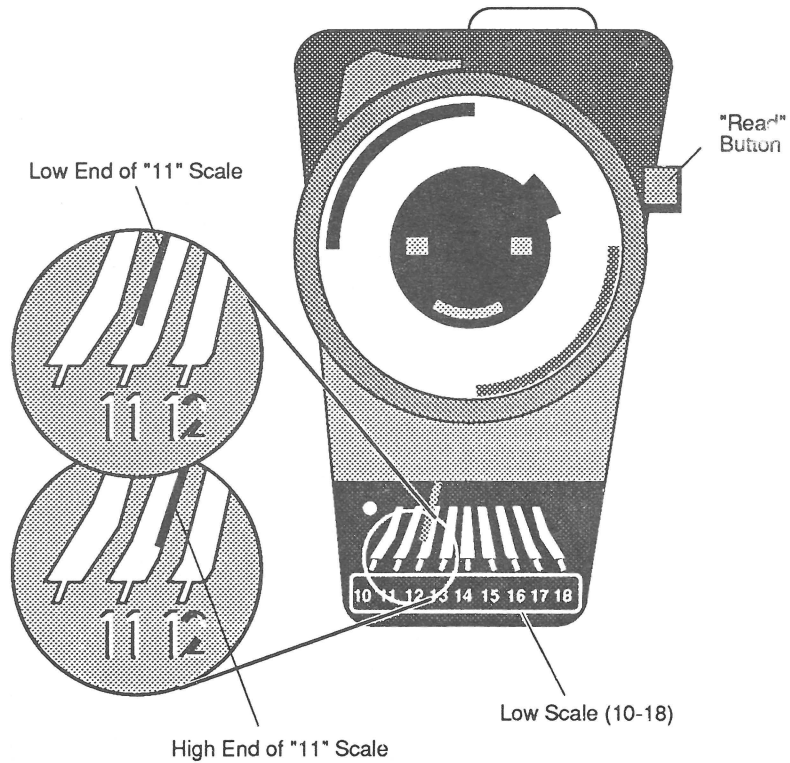


FIGURE 14

*Using the Light Meter
to Measure
Screen Luminance*

Use the light meter to measure the screen luminance of the Portrait Display as follows:

1. Verify that the light meter is functioning correctly by pressing the red button on the back of the meter. If the reading moves to the right of the red notch, replace the battery.
2. Move the side switch up so that the lower scale reads 10 through 18 (**Figure 14**).
3. Move the lens hood aside to uncover the lens of the meter. Place the lens against the screen exactly at screen center, press the "read" button, and obtain the light meter reading on the lower scale (**Figure 14**).

Apple Macintosh Portrait Display “Series B”

Section 4 – Troubleshooting

❑ CONTENTS

4.2	Introduction
4.3	Symptom Chart
4.3	Raster Problems
4.4	Video Display Problems
4.4	Miscellaneous Problems

□ INTRODUCTION

The symptom chart for the Macintosh Portrait Display describes problems that may occur with the monitor, and then presents a list of possible solutions. Find the description that best matches the symptom(s) displayed by the monitor, and perform the corrective actions in the order listed.

If the first action does not fix the problem, try the next action on the list. If you replace a module and the problem still exists, reinstall the original module before performing the next repair action.

The symptom chart for the Macintosh Portrait Display is divided into raster problems, video display problems, and miscellaneous problems. Raster problems are those affecting the lit portion of the screen only; video problems are those affecting the quality of the video image produced on the screen.

WARNING: Read all the safety precautions (see Section 1, Basics) and perform the CRT discharge procedure (see Section 2, Take-Apart) before removing or installing any modules.

□ SYMPTOM CHART

Raster Problems

Solutions

- *No raster
(LED does not light)*
 1. Check fuse; replace if blown. If it blows again, go to the next step.
 2. Replace main deflection board.
 3. Replace video board.

- *No raster
(LED is on)*
 1. Replace main deflection board.
 2. Replace video board.

- *Raster not
centered*
 1. Perform horizontal or vertical center adjustments.
 2. Replace main deflection board.

- *Raster stretched or
compressed at top
or bottom*
 1. Perform vertical linearity adjustment.
 2. Replace main deflection board.

- *Characters on left
larger or smaller than
characters on right*
 1. Perform horizontal linearity adjustment.
 2. Replace main deflection board.

- *One thin, bright,
horizontal line
appears across
screen*
 1. Replace main deflection board.
 2. Replace cathode-ray tube (CRT).

- *Raster short (not
276 mm high)*
 1. Perform vertical height adjustment.
 2. Replace main deflection board.

- *Raster narrow (not
203 mm wide)*
 1. Perform horizontal size adjustment.
 2. Replace main deflection board.

- *Raster bowed
or barrel shaped*
 - Replace main deflection board.

Raster Problems (continued)

Solutions

- *Raster pyramid shaped (or inverted pyramid)*
 - Replace the cathode-ray tube (CRT).

Video Display Problems

Solutions

- *Picture breaks into diagonal lines*
 - Replace main deflection board.
- *Picture rolls vertically*
 - Replace main deflection board.
- *Display too dark or too bright, or retrace lines are present*
 1. Perform video adjustments.
 2. Replace video board.
 3. Replace contrast brightness board.
 4. Replace cathode-ray tube (CRT).
- *Out of focus*
 1. Perform focus adjustments.
 2. Replace main deflection board.
 3. Replace dynamic focus board.
 4. Replace cathode-ray tube (CRT).

Miscellaneous Problems

Solutions

- *Black spots on screen (burnt phosphors)*
 - Replace cathode-ray tube (CRT).
- *Monitor emits high-pitched squeal*
 - Replace main deflection board.
- *Monitor shuts down*
 1. Perform video adjustments.
 2. Replace main deflection board.

Apple Macintosh Portrait Display "Series B"

Illustrated Parts List

❑ CONTENTS

- IPL.3 Macintosh Portrait Display "Series B"—System
Exploded View (Figure 1)
- IPL.5 Cables (Figure 2)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple Macintosh Portrait Display "Series B", along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

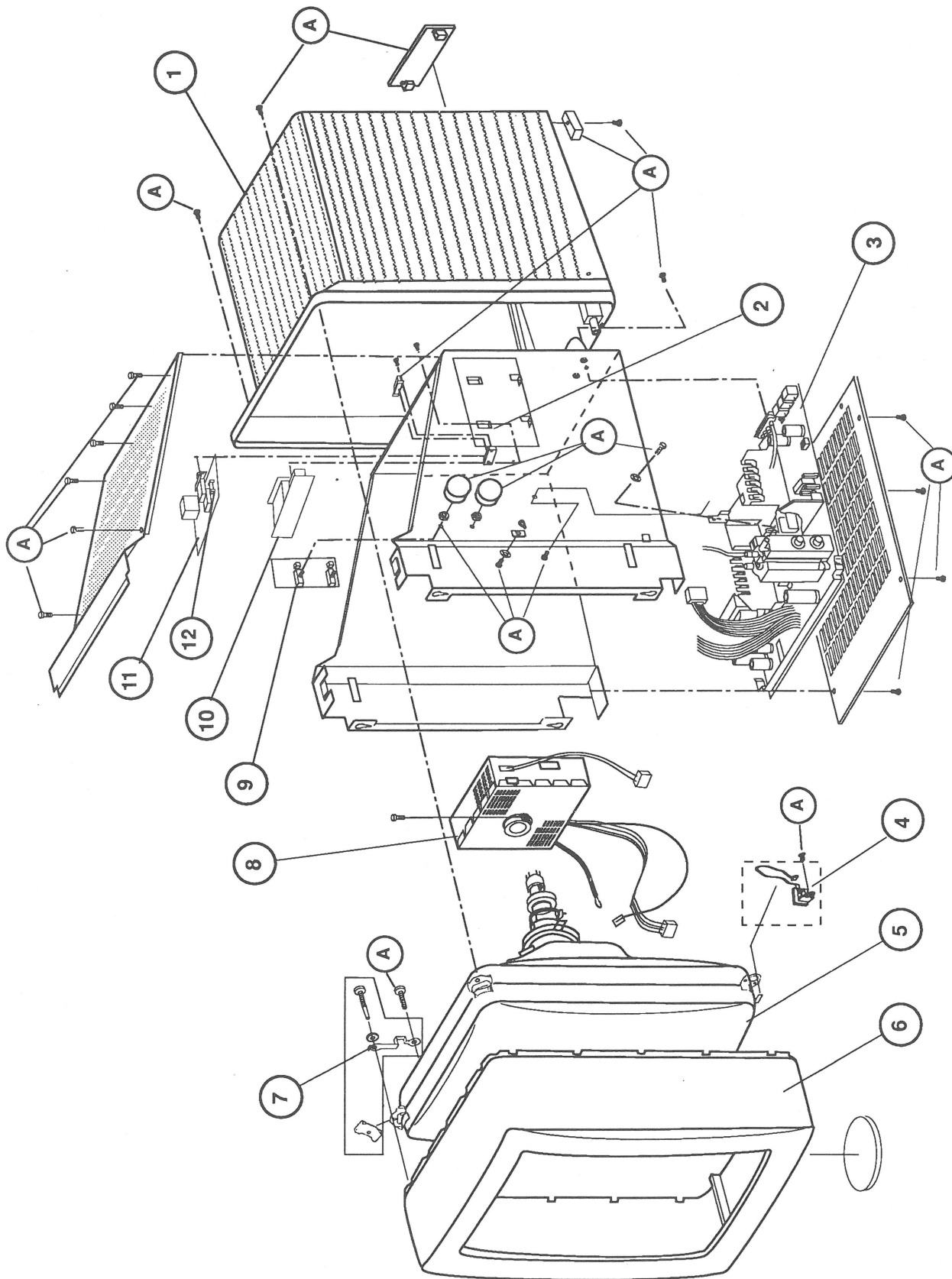


FIGURE 1

□ MACINTOSH PORTRAIT DISPLAY "SERIES B"—SYSTEM EXPLODED VIEW (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	949-0245	Plastic Rear Cover
2	661-1603	Dynamic Focus Board, VDE-B version
3	661-0580	Main Deflection Board, VDE-B version
4	590-0610	LED Cable Assembly
5	076-0331	CRT Assembly, VDE-B version
	076-0391	CRT Assembly, VDE-B version, Antistatic
6	949-0244	Plastic Case Bezel
7	076-0322	CRT Mounting Kit
8	661-0539	Video Board
9	982-0028	Contrast Brightness Board
10	915-0043	AC Inlet/Filter Assembly, 110/240 V
11	937-0043	On/Off Switch Assembly
12	941-0018	Fuse, 1.25A, 250 V (5/pk)
A	956-0020	Screw/Knob Set

The Screw/Knob Set consists of the items listed below. Items are not available for purchase separately, but are identified as A in Figure 1.

On/Off Switch Button (1)
 Brightness/Contrast Knob (1)
 Service Panel Door (1)
 Rubber Foot (4)
 Pan-Head Screws (32)
 Hex Screws (4)
 Star Washers (4)
 Flat-Head Screws (1)

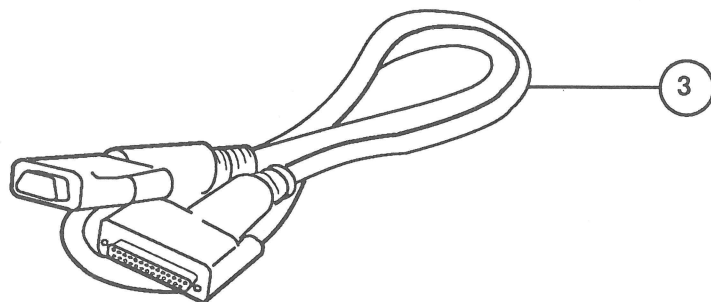
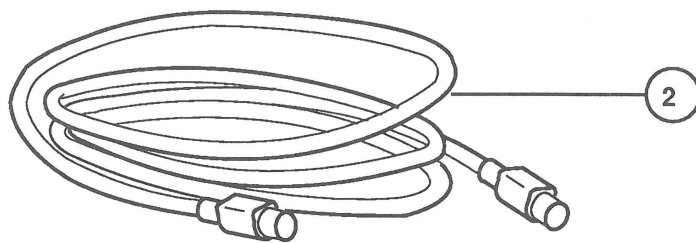
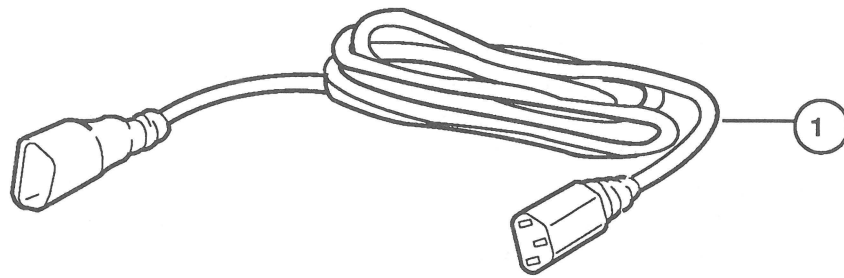


FIGURE 2

□ CABLES (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	590-0421	Power Cable, 1.9 m
2	590-4501	Cable, ADB, 1.9 m
3	590-0574	Video Cable, DB25 to DB25
	590-0615	Video Cable, DB15 to DB25

Macintosh 12-Inch Monochrome Display

Technical Procedures

□ TABLE OF CONTENTS

Section 1 – Basics	1.2	Product Description
	1.3	External Controls
	1.5	External Connectors
	1.6	Module Identification
	1.7	Care and Handling
 Section 2 – Take-Apart	 2.2	 Rear Cover
	2.5	Discharging the Cathode-Ray Tube (CRT)
	2.6	Discharge Procedure
	2.7	Anode Cap
	2.8	Main Deflection PCB
	2.11	Cathode-Ray Tube
	2.13	Contrast/Brightness Assembly
	2.15	LED Assembly
 Section 3 – Adjustments	 3.2	 Introduction
	3.3	Safety Instructions
	3.4	Live Adjustment Rules
	3.5	Location of Controls
	3.5	User Controls
	3.5	External Service Controls
	3.6	MacTest II/IIx Video Test Patterns
	3.6	Materials Required
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	3.9	Horizontal Adjustments
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	3.11	Focus Adjustment
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	3.12	MacTest MP Video Test Patterns
	3.12	Materials Required
	3.12	Generating the Test Patterns

**Section 4 –
Troubleshooting**

- 4.2 Introduction
- 4.2 Symptom Chart

**Illustrated
Parts List**

- IPL.3 Exploded View – Macintosh 12-Inch Monochrome
Display Subassemblies (Figure 1)

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Macintosh 12-Inch Monochrome Display

Section 1 – Basics

□ CONTENTS

- 1.2 Product Description
- 1.3 External Controls
- 1.5 External Connectors
- 1.6 Module Identification
- 1.7 Care and Handling

□ PRODUCT DESCRIPTION

The Macintosh® 12-Inch Monochrome Display is a high-resolution, 12-inch (diagonal) monochrome monitor that can be used with any Macintosh computer that has a NuBus™ expansion slot.

A Macintosh II video card is required to operate the monitor (refer to *Macintosh Family Cards Technical Procedures* for more information about the video card).

The Macintosh 12-Inch Monochrome Display features:

- 640 horizontal and 480 vertical pixels
- 76-dots-per-inch resolution
- Up to 256 shades of gray (with video card expansion kit)
- 66-Hz refresh rate
- A universal power supply
- Compatibility with Apple Universal Monitor Stand

External Controls

The power switch, contrast control, and brightness control (**Figure 1-1**) are the only controls recommended for user access. The brightness control has a detent for midrange reference. A green LED at the lower-left front corner of the front bezel indicates when the power is on.

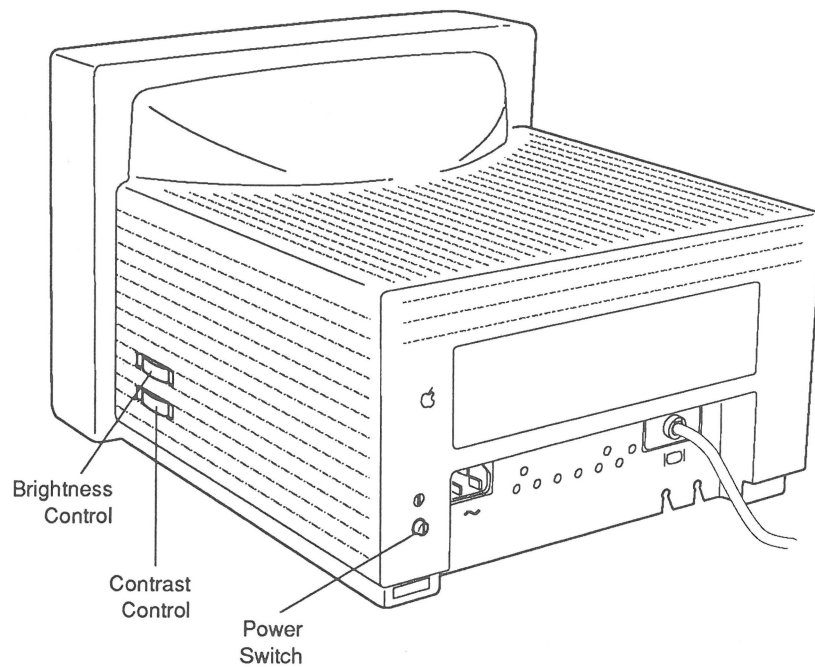


Figure 1-1 External Controls

The Macintosh 12-Inch Monochrome Display has seven other adjustment controls accessible through the rear cover. These controls are not user controls, but well-meaning users may misalign them. The internationally recognized symbols shown in **Figure 1-2** are used to identify the following controls:

- H.SIZE (horizontal size)
- H.CENT (horizontal centering)
- V.SIZE (vertical size)
- V.CENT (vertical centering)
- CONT (contrast)
- BRIGHT (brightness)
- FOCUS (focus)

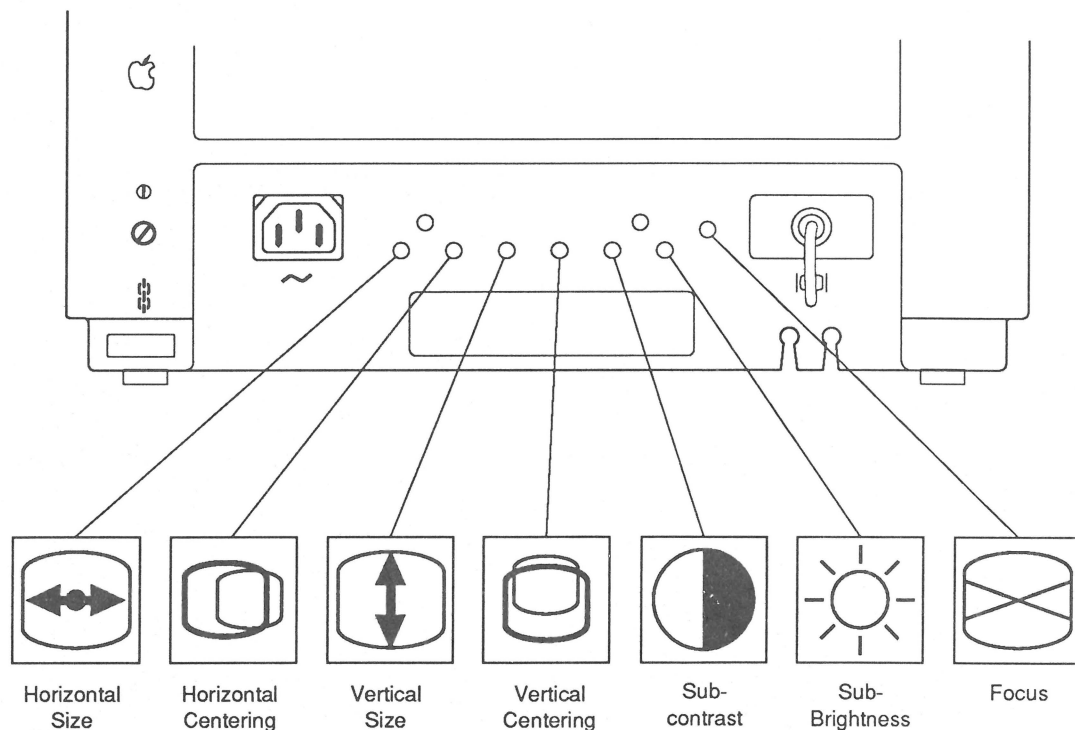


Figure 1-2 Additional Controls

External Connectors

The Macintosh 12-Inch Monochrome Display has two external connectors, an opening for an attachable security lock, and a permanently attached video cable on the rear panel (**Figure 1-3**). Underneath is a bobbin for storing excess video cable.

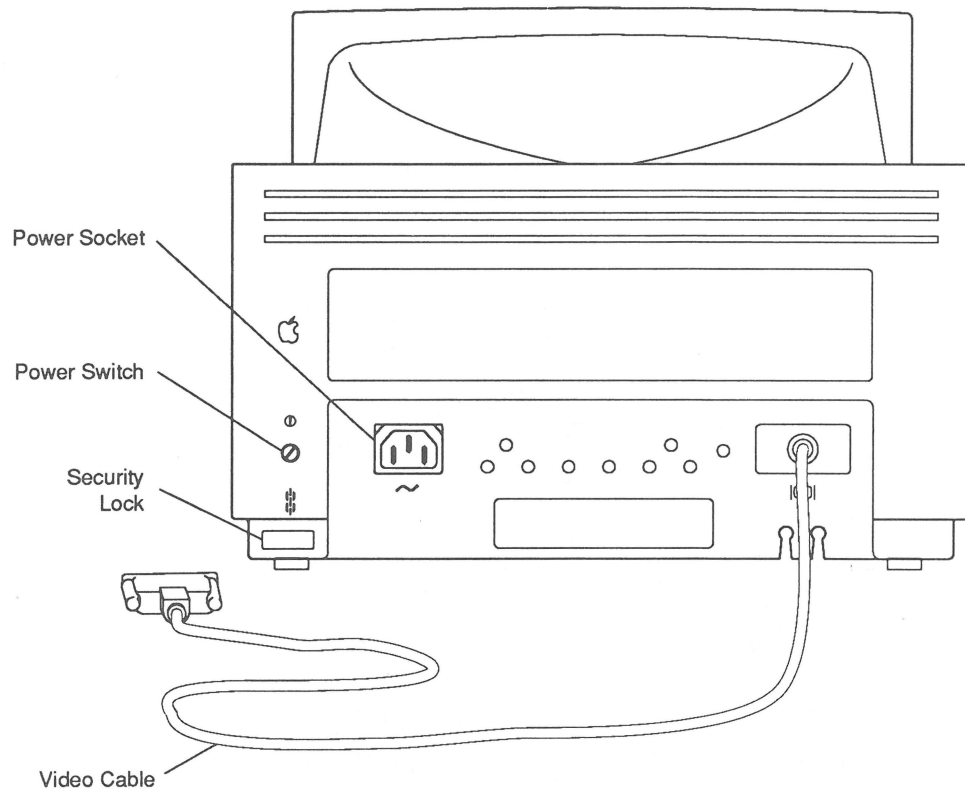


Figure 1-3 External Connectors

□ MODULE IDENTIFICATION

The Macintosh 12-Inch Monochrome Display is designed for ease of service and maintenance. Most adjustments are accessible from the outside to reduce the need to open the monitor for normal maintenance. The monitor chassis is designed to be easy to replace.

The Macintosh 12-Inch Monochrome Display includes the following modules and replaceable parts **(Figure 1-4)**:

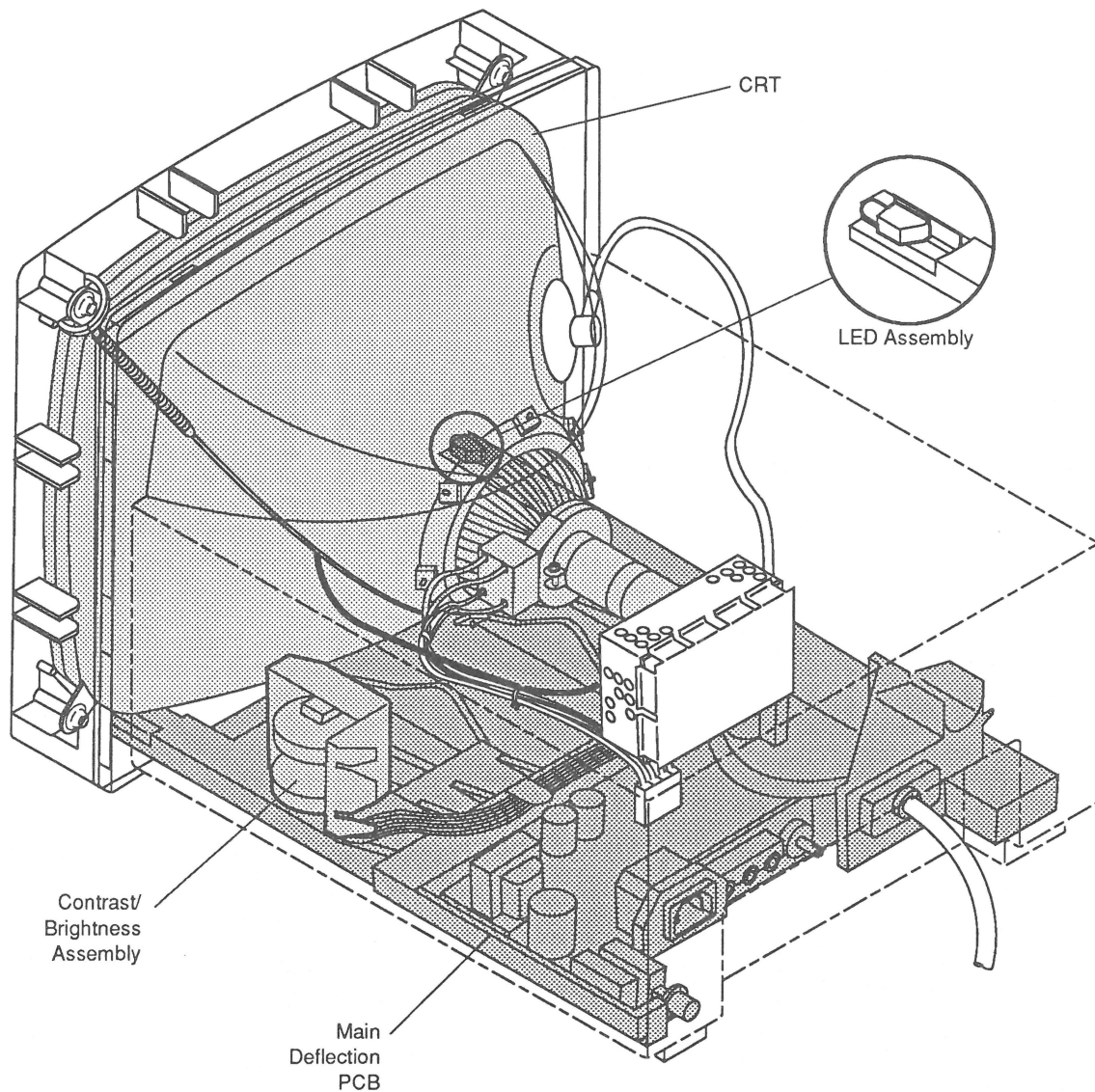


Figure 1-4 Module Identification

□ CARE AND HANDLING

The Macintosh 12-Inch Monochrome Display is a precision instrument that must be handled with care to ensure proper operation. Dropping the monitor, however slightly, can cause CRT alignment problems.

Keep service modules and finished-goods monitors in the Apple® packaging until use, and pack modules in approved packing before returning to Apple for repair.

The Macintosh 12-Inch Monochrome Display contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

Macintosh 12-Inch Monochrome Display

Section 2 – Take Apart

□ CONTENTS

2.2	Rear Cover
2.5	Discharging the Cathode-Ray Tube (CRT)
2.6	Discharge Procedure
2.7	Anode Cap
2.8	Main Deflection PCB
2.11	Cathode-Ray Tube
2.13	Contrast/Brightness Assembly
2.15	LED Assembly

□ REAR COVER

Materials Required

Long magnetic Phillips screwdriver

WARNING: The Macintosh 12-Inch Monochrome Display contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the back cover. **Failure to follow the safety rules could result in serious injury.**

Remove

1. Switch off the monitor, disconnect the AC power cord from the monitor, and disconnect the video cable from the computer.
2. Place the monitor face-down on a soft, protective surface to avoid damaging the CRT screen.

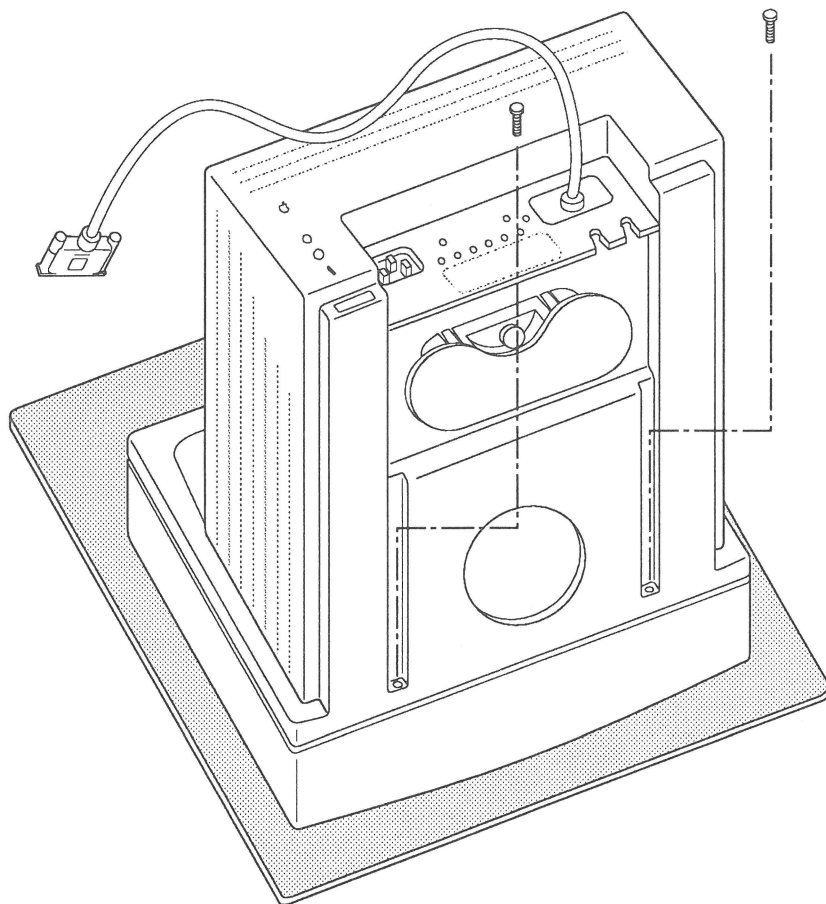


Figure 2-1 Rear Cover Screw Removal

3. With the bottom of the monitor facing you, remove the two case screws (**Figure 2-1**) from the rear cover.
4. With the top of the monitor facing you, release the two retaining tabs on the top front of the rear cover by pressing on the rear edge of the bezel while applying upward pressure on the rear cover (**Figure 2-2**).

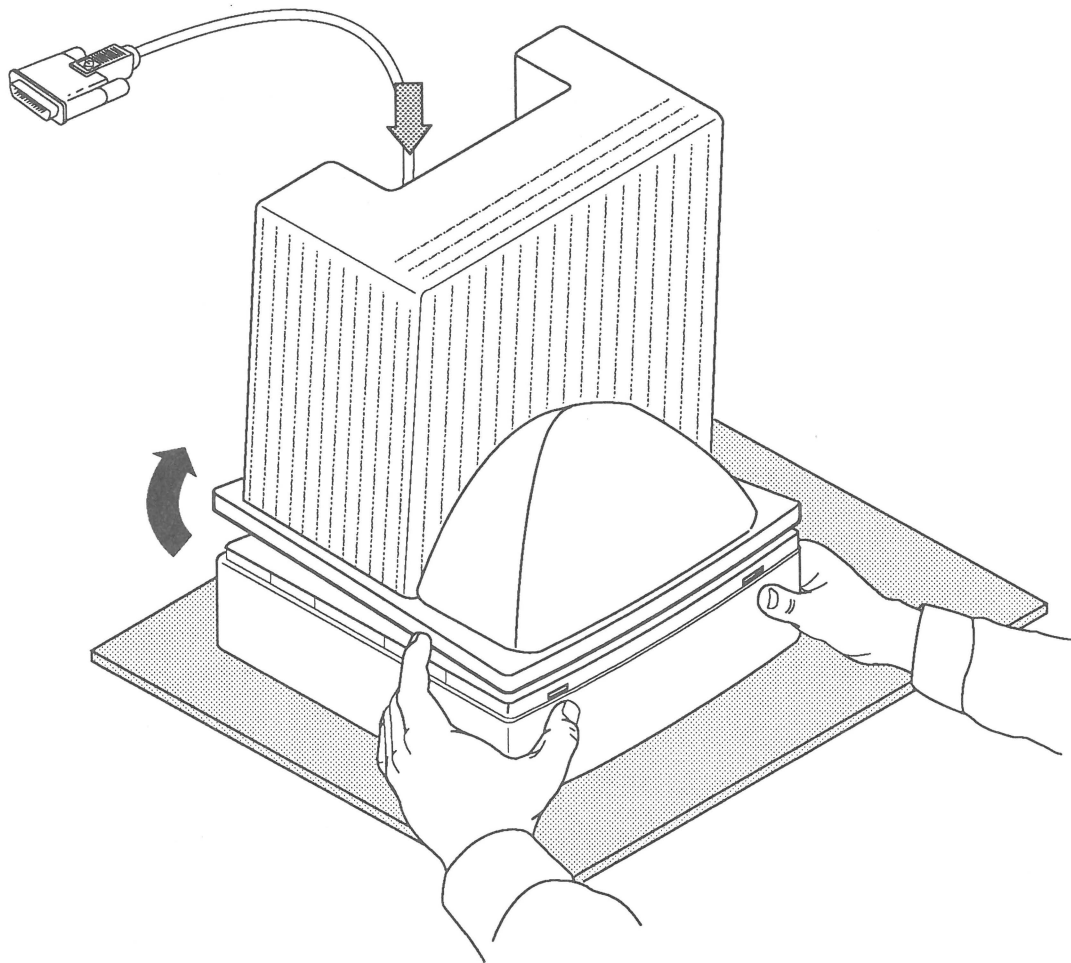


Figure 2-2 Rear Cover Removal

5. Lift the rear cover off the front bezel while feeding the attached video cable out through its opening in the cover.

Replace

1. Carefully set the monitor face-down on a soft, protective surface.
2. Feed the video cable through the opening in the left rear of the rear cover.
3. Slide the rear cover onto the bezel, press the top edge into place to set the two retaining tabs, and replace the two case screws (**Figure 2-2**). You may need to apply slight inward pressure on the rear cover to get it to slide into place over the screw bosses.

Note: Ensure the contrast/brightness knobs are aligned with the openings in the rear cover before replacing screws. If the knobs are not aligned in the openings, remove rear cover, realign the assembly, and replace the rear cover.

4. Carefully set the monitor upright.

□ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The Macintosh 12-Inch Monochrome Display is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off.

Follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
Long magnetic Phillips screwdriver
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the You Oughta Know tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.

WARNING: To prevent serious injury, before discharging the CRT never touch the yoke wires, the anode wire, the anode connector, or the flyback transformer.

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**
2. Remove the rear cover.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

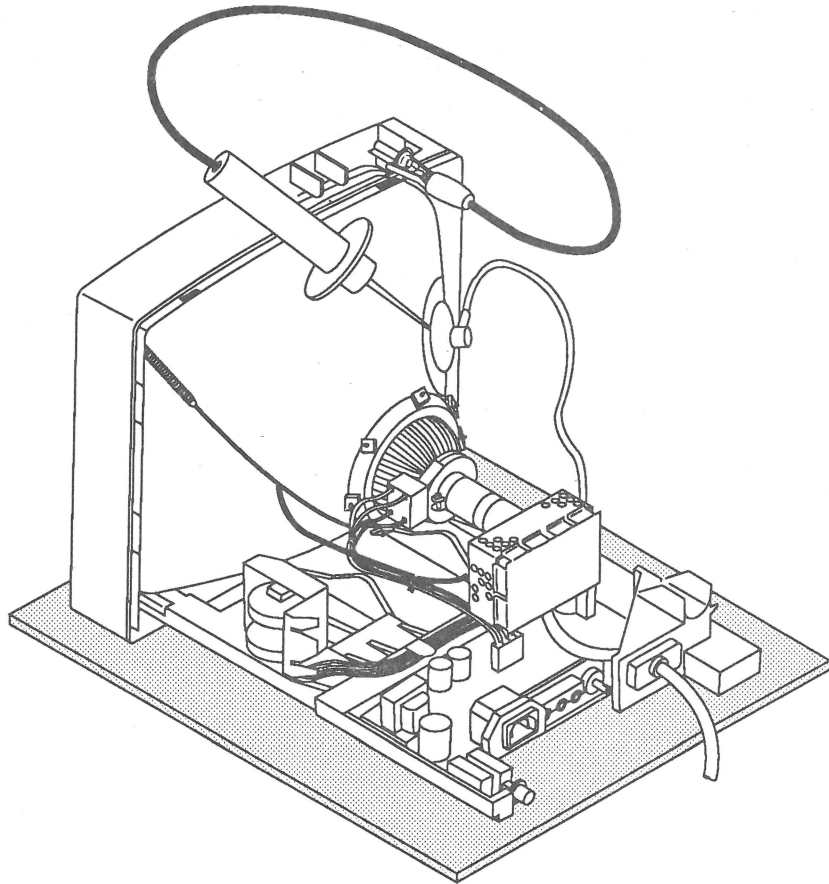


Figure 2-3 Discharging the CRT

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (**Figure 2-3**).
5. Put one hand behind your back and grasp the handle of the discharge tool with your other hand.

WARNING: To prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure, use only one hand when discharging the CRT.

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (**Figure 2-3**) until the probe touches the anode ring.
7. Remove the probe of the CRT discharge tool from under the anode cap and detach the clip from the metal chassis.

Anode Cap

For some procedures, you will have to remove the anode cap (**Figure 2-4**). After you have discharged the CRT, peel back the anode cap until you can see the anode ring (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

Note: If the bleeder resistor fails, a secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert the connector into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press on the edges of the rubber anode cap to ensure a firm seal.

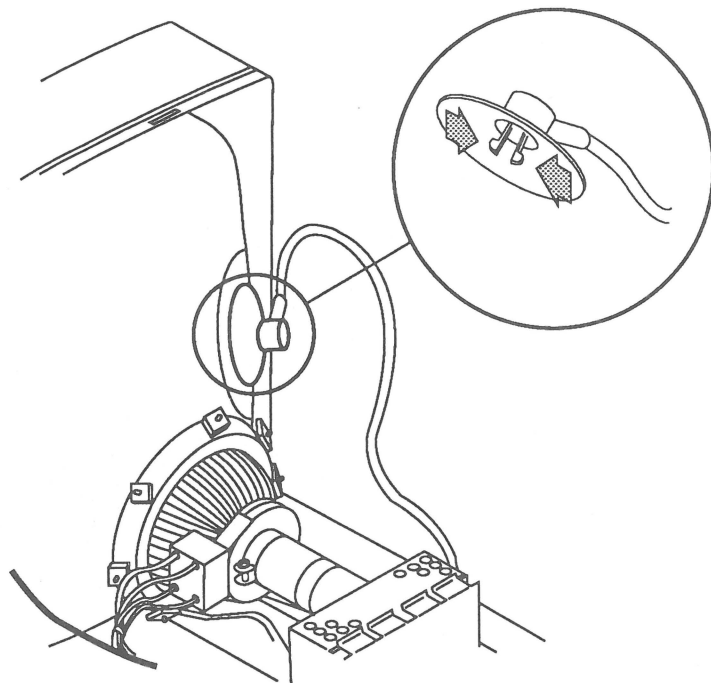


Figure 2-4 Anode Cap Detail

□ MAIN DEFLECTION PCB

Materials Required

Long magnetic Phillips screwdriver
Needlenose pliers

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Position the monitor face-down with the main deflection PCB facing away from you.
3. Remove the Phillips CRT mounting screw from the upper-left corner (**Figure 2-5**) of the CRT mounting bracket. Loosen but do not remove the other three Phillips CRT mounting screws (**Figure 2-5**).

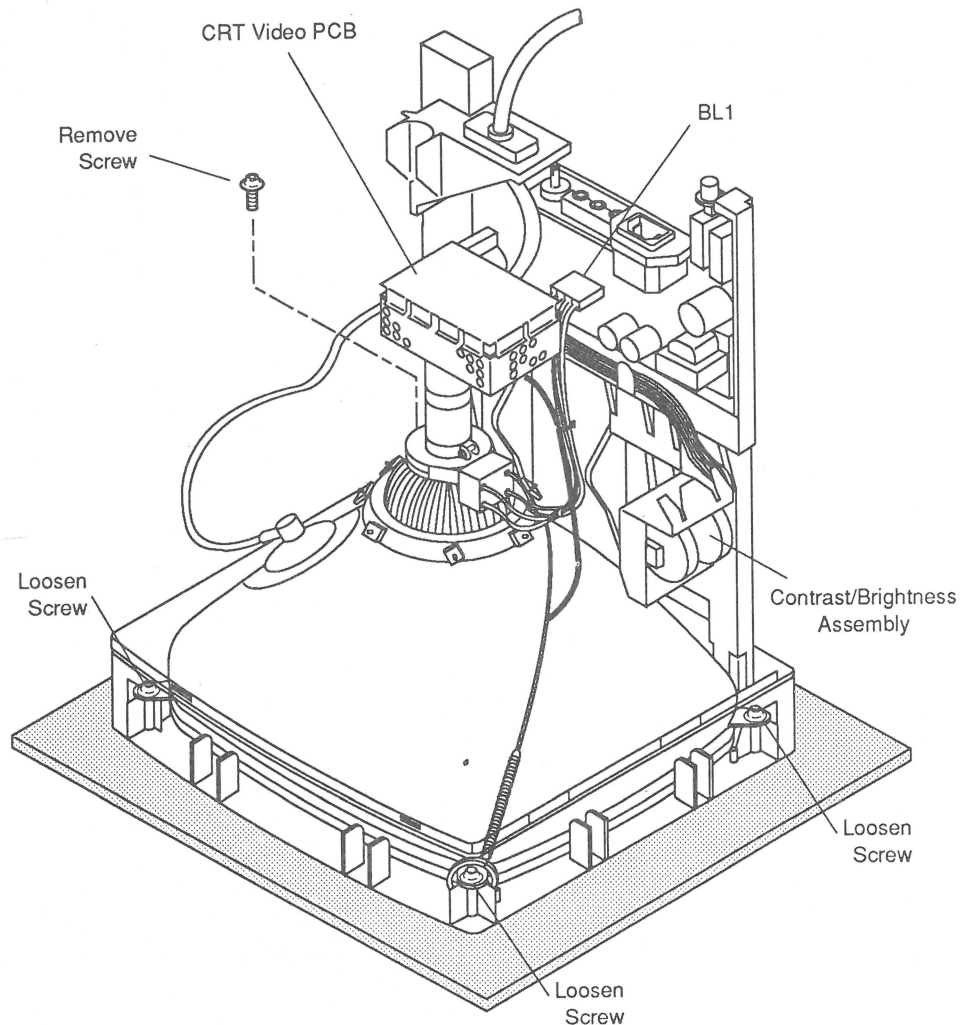


Figure 2-5 Main Deflection PCB

4. Remove the CRT video PCB (attached to the neck of the CRT) by pulling it straight up. Use caution because the cables between this box and the main deflection PCB are very short.
5. Carefully disconnect connector BL1 from the main deflection PCB (**Figure 2-5**) and remove the twist tie holding the cable to the ground (black) wire.
6. Disconnect the spring from the ground braid on the right side of the CRT.
7. Grasping the CRT near the bottom of the neck, gently tilt the CRT enough toward the right front to slip the ground braid from under the left-rear corner of the CRT mounting bracket.
8. Remove the main deflection PCB by grasping the contrast/brightness assembly on the right and the plastic upright on the left, and apply steady pressure straight up.

Replace

1. Slide the two uprights into the channels in the bottom of the front bezel.
2. Grasping the CRT near the bottom of the neck, gently tilt the CRT toward the right front and slip the ground braid under the left-rear tab of the CRT mounting bracket.
3. Reconnect the spring to the ground braid.

Note: Ensure the braid is flat against the back of the CRT and not over any of the yoke magnets. Also ensure the black ground wire is positioned on the right side of the CRT neck to allow proper replacement of the twist tie.

4. Using needlenose pliers, press the two prongs on the anode connector together and insert it into the anode aperture on the CRT. Tug on the anode wire to make sure it is firmly seated, and then press down on the edges of the rubber anode cap to ensure a firm seal.
5. Reconnect connector BL1 to the main deflection PCB and replace the twist tie holding the cable to the ground (black) wire.
6. Carefully replace the CRT video PCB on the neck of the CRT.
7. Replace the Phillips screw in the upper-left corner of the CRT mounting bracket and tighten all four screws.
8. Replace the rear cover.

□ CATHODE-RAY TUBE

Materials Required

Long magnetic Phillips screwdriver
Needlenose Pliers

Remove

1. Remove the rear cover, discharge the CRT and remove the anode cap.
2. Remove the main deflection PCB.
3. Remove the three remaining screws holding the CRT to the front bezel.
4. Remove the white nylon ring, with the spring attached, from the right-front mounting tab on the CRT mounting bracket (**Figure 2-6**).

CAUTION: *The neck of the CRT is easily damaged. Do not grab the neck of the CRT to remove it from the bezel. If necessary, have a helper hold down the bezel while you grab the CRT by its edges and remove it.*

5. Lift the CRT out of the bezel.

Note: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the You Oughta Know tab.*

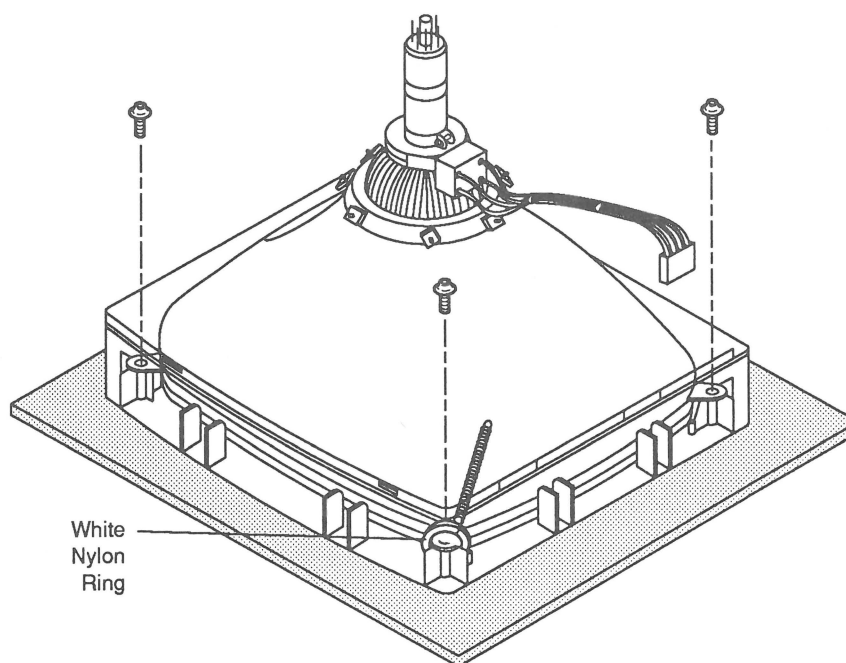


Figure 2-6 CRT Removal

Replace

1. Place the CRT carefully on the front bezel. With the top of the front bezel facing you, the anode aperture should be on the left side.
2. Replace the white nylon ring, with the spring attached, over the right-front mounting tab on the CRT mounting bracket.
3. Loosely install three mounting screws on the lower-left, lower-right, and upper-right mounting tabs on the CRT mounting bracket.
4. Using needlenose pliers, press the two prongs on the anode connector together and insert it into the anode aperture on the CRT. Tug on the anode wire to make sure it is firmly seated, and then press down on the edges of the rubber anode cap to ensure a firm seal.
5. Replace the main deflection PCB.
6. Replace the rear cover.

□ CONTRAST/BRIGHTNESS ASSEMBLY

Materials Required

Long magnetic Phillips screwdriver
25-35 watt soldering iron
Desoldering tool

Remove

1. Remove the rear cover and discharge the CRT.
2. Remove the contrast/brightness assembly from the main deflection PCB mounting frame by applying upward pressure to the underside of the plastic mounting post (**Figure 2-7A**). The post will snap out from the main deflection PCB mounting frame.
3. Remove the contrast/brightness PCB from the plastic mounting frame by applying outward pressure to the upper mounting tabs with your thumbs while gently applying upward pressure on the cable with your index finger. Tilt the PCB out from under the two tabs at the lower side of the mounting frame and remove the frame.
4. Locate BV4 where the cable connects to the contrast/brightness PCB (**Figure 2-7B**).
5. From the back of the contrast/brightness PCB, desolder the six cable wires one at a time, making sure to remove as much solder as possible. Ensure the cable wires are completely loose before proceeding.
6. Carefully pull the cable loose from the contrast/brightness PCB. Using the desoldering tool, remove all remaining solder from the holes in the contrast/brightness PCB.

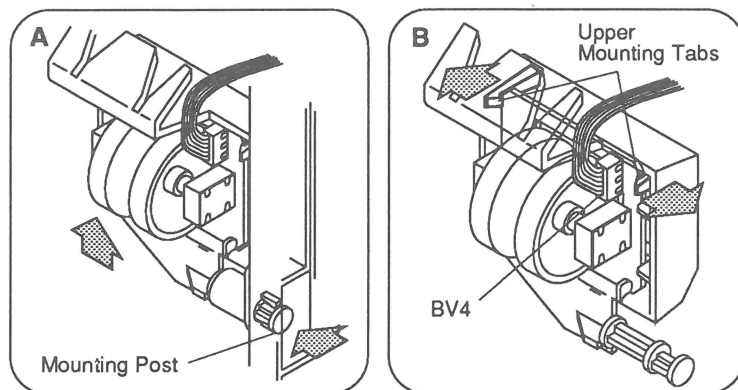


Figure 2-7 Contrast/Brightness Assembly

Replace

1. Insert the six wires from the contrast/brightness assembly into the holes at BV4. Orient the cable so the red wire faces the upper edge of the PCB (**Figure 2-8**).
2. From the back of the contrast/brightness PCB, solder the six wires into place.
3. Holding the contrast/brightness assembly mounting frame with the mounting post downward, slide the contrast/brightness PCB under the two mounting tabs at the bottom of the frame and apply pressure to the top of the variable resistors until the PCB snaps into place.
4. Snap the contrast/brightness assembly into the main deflection PCB mounting frame by applying downward pressure to the top of the assembly (**Figure 2-8**). The mounting post will snap into position.
5. Replace the rear cover.

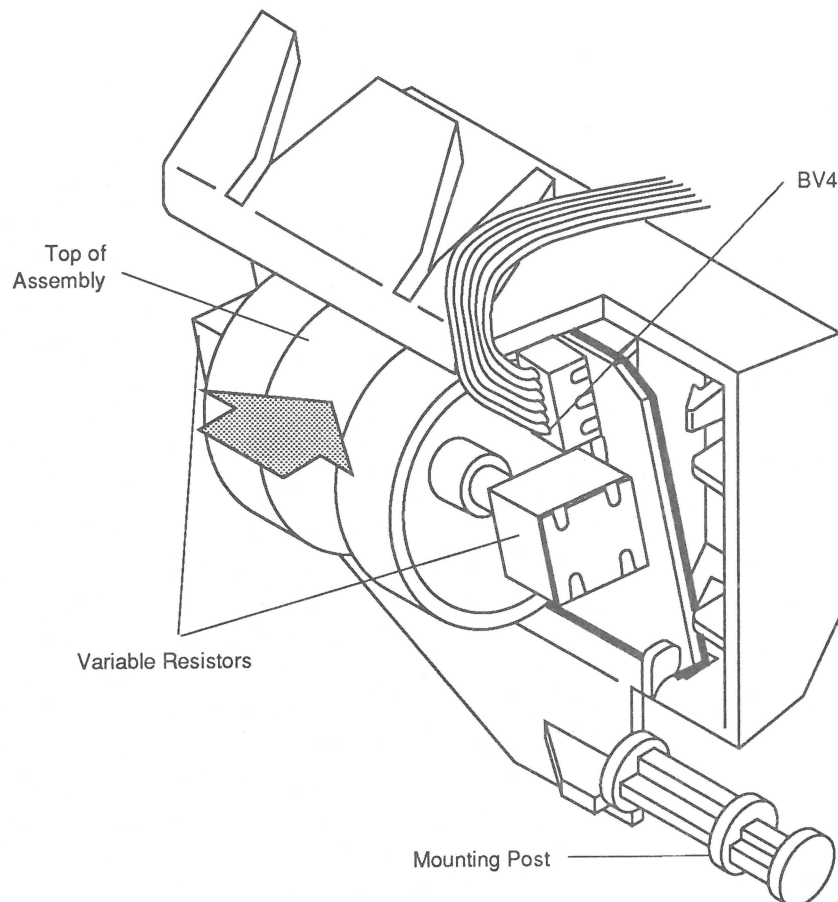


Figure 2-8 Contrast/Brightness Assembly

□ LED ASSEMBLY

Materials Required

Long magnetic Phillips screwdriver
25-35 watt soldering iron
Desoldering tool

Remove

1. Remove the rear cover and discharge the CRT.
2. Remove the Main Deflection PCB.
3. Remove the LED assembly by applying pressure to the mounting tab and pulling up on the LED assembly (**Figure 2-9**).
4. Remove the two-wire cable from under the routing tab on the main deflection PCB mounting frame.
5. From the back of the LED PCB, desolder and remove the two wires coming from the main deflection PCB. Using the desoldering tool, ensure the holes are as free from solder as possible.

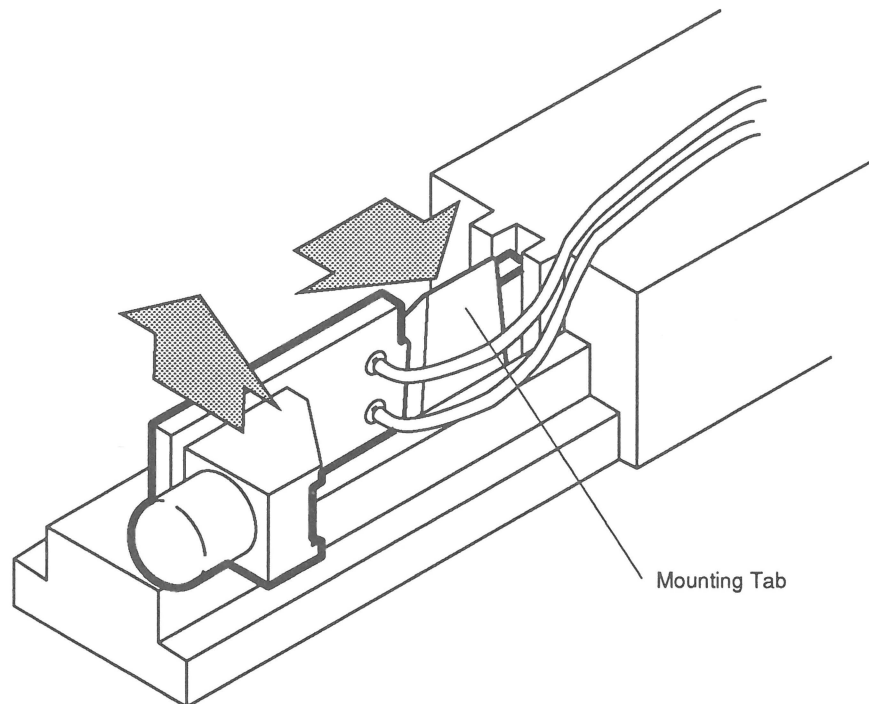


Figure 2-9 LED Assembly Removal

Replace

1. Insert the two wires into the correct holes in the LED PCB (the holes are marked *white* and *red*) and solder into place.
2. Route the two-wire cable through the routing tab on the main deflection PCB mounting frame.
3. Insert the LED assembly into the mounting pocket in the main deflection PCB mounting frame, with the LED to the right, and press down until it snaps into place.
4. Replace the main deflection PCB.
5. Replace the rear cover.

Macintosh 12-Inch Monochrome Display

Section 3 – Adjustments

□ CONTENTS

3.2	Introduction
3.3	Safety Instructions
3.4	Live Adjustment Rules
3.5	Location of Controls
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3.6	MacTest II/IIx Video Test Patterns
3.6	Materials Required
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3.11	Sub-Brightness Adjustment
3.12	Subcontrast Adjustment
3.12	MacTest MP Video Test Patterns
3.12	Materials Required
3.12	Generating the Test Patterns

□ INTRODUCTION

Whenever you replace a module within the Macintosh 12-Inch Monochrome Display, some adjustment of the video display may be necessary. As a general rule, replacing the main deflection PCB may require making geometric (vertical/horizontal) or focus adjustments. Replacing the CRT or video board requires video adjustments.

IMPORTANT: Do not attempt tilt or ring adjustments on the Macintosh 12-Inch Monochrome Display. All such yoke adjustments are performed by the manufacturer.

Use the following procedures to perform horizontal, vertical, focus, and video adjustments. If these procedures do not correct the monitor's adjustment problems, isolate the faulty module, replace it, and return it to Apple.

□ SAFETY INSTRUCTIONS

WARNING: *Macintosh 12-Inch Monochrome Display contains a high-vacuum picture tube and operates at very high voltages. To prevent serious injury, read "Care and Handling" in Section 1, Basics, before you proceed.*

In addition to following guidelines in the Basics section, be sure to

- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with the other hand.
- Use a mirror for viewing the adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to rotate the controls—you cannot see what you are about to touch.
- Perform only the adjustments that are absolutely necessary. Do not attempt to make any adjustments other than the ones explained in this section, and do these with extreme caution.

WARNING: Serious injury could result if, with the power on, you touch any of the components shown in **Figure 3-1**.

Live Adjustment Rules

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Macintosh 12-Inch Monochrome Display (**Figure 3-1**):

- Any part of the yoke assembly, including all yoke wires
- The anode wire
- The anode connector
- The flyback transformer
- The AC power portion of the main deflection PCB

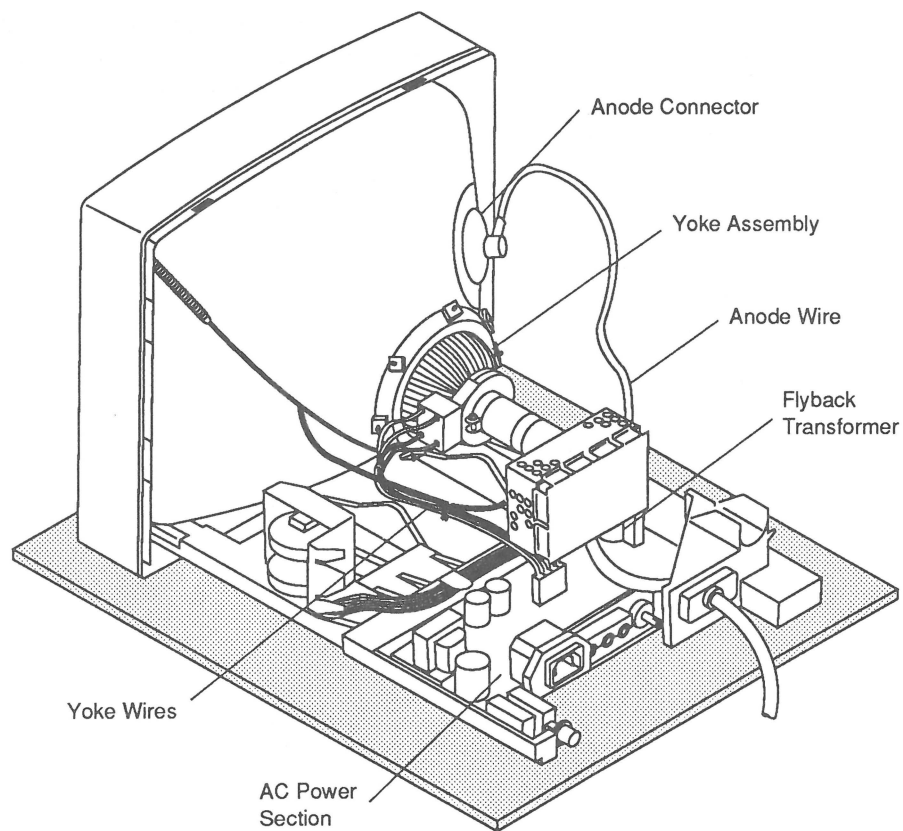


Figure 3-1 Dangerous Areas

□ LOCATION OF CONTROLS

User Controls

The brightness control and contrast control are located on the right side of the monitor and are accessible to the user (**Figure 3-2**).

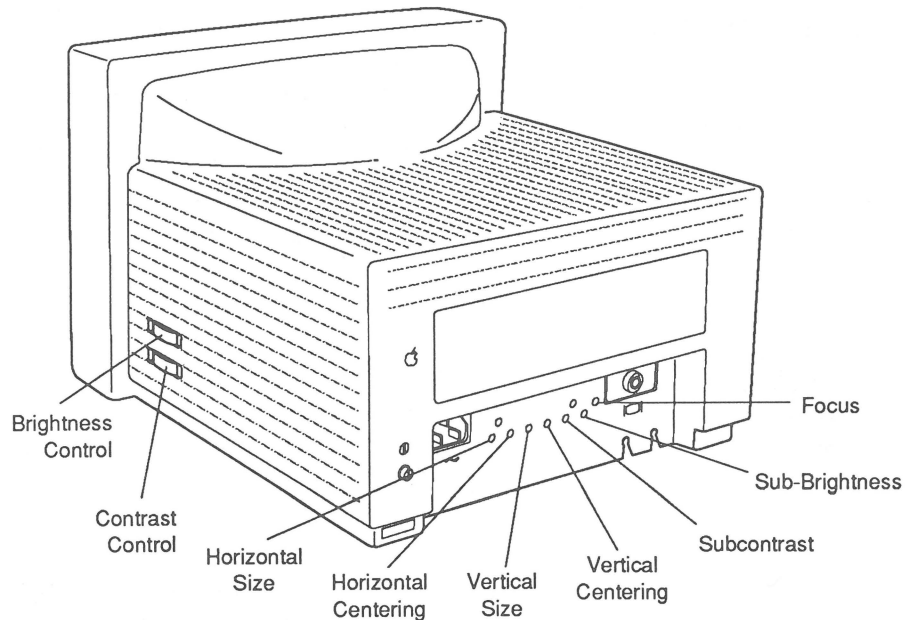


Figure 3-2 User and External Service Controls

External Service Controls

The following service adjustment controls are located on the main deflection PCB but can be accessed through the rear cover without removing the cover.

- H.SIZE (horizontal size)
- H.CENT (horizontal centering)
- V.SIZE (vertical size)
- V.CENT (vertical centering)
- CONT (subcontrast)
- BRIGHT (sub-brightness)
- FOCUS (focus)

□ MACTEST II/Ix VIDEO TEST PATTERNS

Use the following procedure to display test patterns on a Macintosh 12-Inch Monochrome Display that is connected to a Macintosh II or Macintosh IIfx computer.


Materials Required

Macintosh II or Macintosh IIfx
Macintosh II Video Card
MacTest™ II/Ix diagnostic disk (version 3.1 or higher)

IMPORTANT: *The Macintosh II Video Card RAM must be upgraded to 512K in order to display the MacTest II/Ix test patterns. Refer to the Macintosh Family Cards Technical Procedures.*

Generating the Test Patterns

MacTest II/Ix tests the video RAM on the Macintosh II Video Card and displays test patterns used to adjust the monitor. Follow the steps below to display the *MacTest II/Ix* test patterns:

1. Connect the monitor's video cable and power cord to the Macintosh II or Macintosh IIfx computer.
2. Boot the *MacTest II/Ix* disk. For computers with more than one drive, boot *MacTest* from Drive 1, the right-side drive.
3. *MacTest II/Ix* will display a window instructing you to turn off the system and connect a SCSI loopback card. Unless you wish to test the logic board, click **OK** to move to the Start window.
4. When the Start window appears on the screen, go to the  menu and open the Control Panel.
5. Click the Monitors icon.
6. In the area called **Characteristics of selected monitor**, select **Grays** and also select **16**.

7. If more than one monitor is connected to the computer, make sure the Macintosh 12-Inch Monochrome Display is the main monitor. (Test patterns can be displayed only on the main monitor. Check the box at the bottom-right of the panel—the monitor icon shown with a menu bar on it is the main monitor. If necessary, drag the menu bar to the icon representing the Macintosh 12-Inch Monochrome Display.)

8. Close the Control Panel to return to the Start window.

Note: If you selected a new main monitor, you must restart *MacTest II/IIx* for this change to take effect. After closing the Control Panel, quit *MacTest II/IIx* and then reboot *MacTest II/IIx*.

9. Select **Test Selections** from the Options menu (or type **⌘T**). When the Test Selections window appears, deselect the default Logic and Disk Drives tests by clicking their selection boxes once.
10. To test video RAM on the video card, click **Video Card in Slot**. Apple recommends testing the video card before performing the video adjustments.
11. Click **Video Monitor** to display the video adjustment test patterns, and click **OK** to close the Test Selections window.
12. When the Start window reappears, click **Start**.

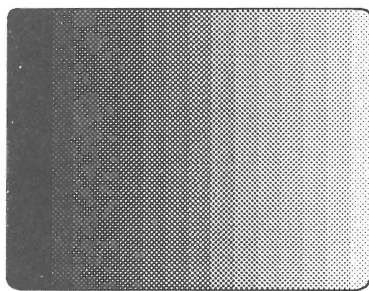
Note: If you selected the video card RAM test, this message will appear: **Testing Macintosh Video Card**. Horizontal and vertical lines will flash across the screen. After about one minute the Start window will reappear, and the Status line will indicate whether the video card has passed the test.

13. An alert box appears to inform you that test patterns can be displayed only on the default monitor. Click **OK** to display the first test pattern.

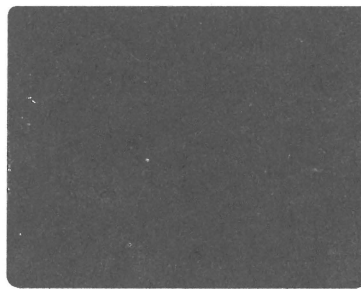
Note: Click the mouse to advance to the test pattern you want. Each test pattern is displayed once. When you have advanced through the test patterns, you will be returned to the Start window. Clicking **Start** will rerun the video RAM test (if selected) and/or redisplay the test patterns. (To display the test patterns without rerunning the video RAM test, deselect **Video Card in Slot** in the Test Selections window.)

14. *MacTest II/IIx* displays the test patterns listed below and shown in **Figure 3-3**:

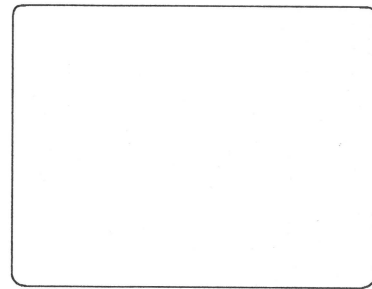
- Gray Bars
- Full Black Screen
- Full White Screen
- Crosshatch I (black background)
- Crosshatch II (white background)
- Focus



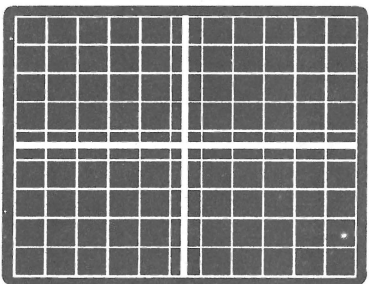
Gray Bars



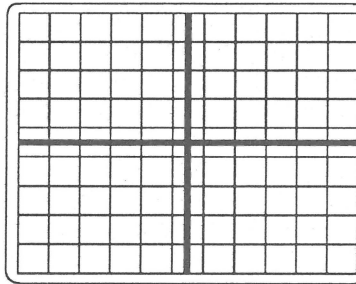
Full Black Screen



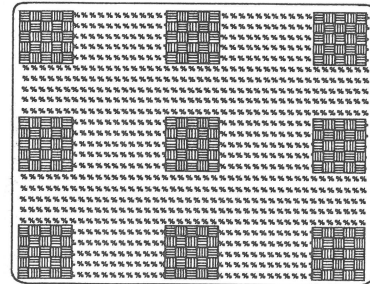
Full White Screen



Crosshatch I
(Black Background)



Crosshatch II
(White Background)



Focus

Figure 3-3 Video Display Patterns

□ ADJUSTMENT PROCEDURES

If a module has been replaced in the monitor, the service adjustments will be made with the rear cover removed.

Materials Required

Plastic adjustment tool (insulated screwdriver)
Mirror
Flexible metric ruler
Sekonic Multi-Lumi Model L-248 Light Meter

Horizontal Adjustments

The horizontal size and centering adjustments use the Full White Screen or Crosshatch II pattern.

Adjusting Horizontal Size

Using the plastic adjustment tool, adjust the horizontal size (H.SIZE) control (**Figure 3-4**) until the width of the display is $213.5 \text{ mm} \pm 2.5 \text{ mm}$.

Note: To measure the raster width, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the left edge of the raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the right edge of the raster, and note the ruler measurement. Adjust the H.SIZE control as necessary.

Adjusting Horizontal Center

Using the insulated screwdriver, turn the horizontal centering (H.CENT) control (**Figure 3-4**) until the raster is centered (left to right) within the bezel.

Vertical Adjustments

The vertical size and centering adjustments use the Full White Screen or Crosshatch II test pattern. To display these patterns, see "Macintosh II/IIx Video Test Patterns."

Adjusting Vertical Size

1. Display the Full White Screen test pattern on the monitor.
2. Using the insulated screwdriver, turn the vertical size (HEIGHT) control (**Figure 3-4**) until the raster is $159.5 \text{ mm} \pm 2.5 \text{ mm}$.

Note: To measure the raster height, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the top edge of the raster, keeping your eye perpendicular to the zero mark. Without moving the ruler, shift your head until the same eye is perpendicular to the bottom of the raster, and note the ruler measurement. Adjust the HEIGHT control as necessary.

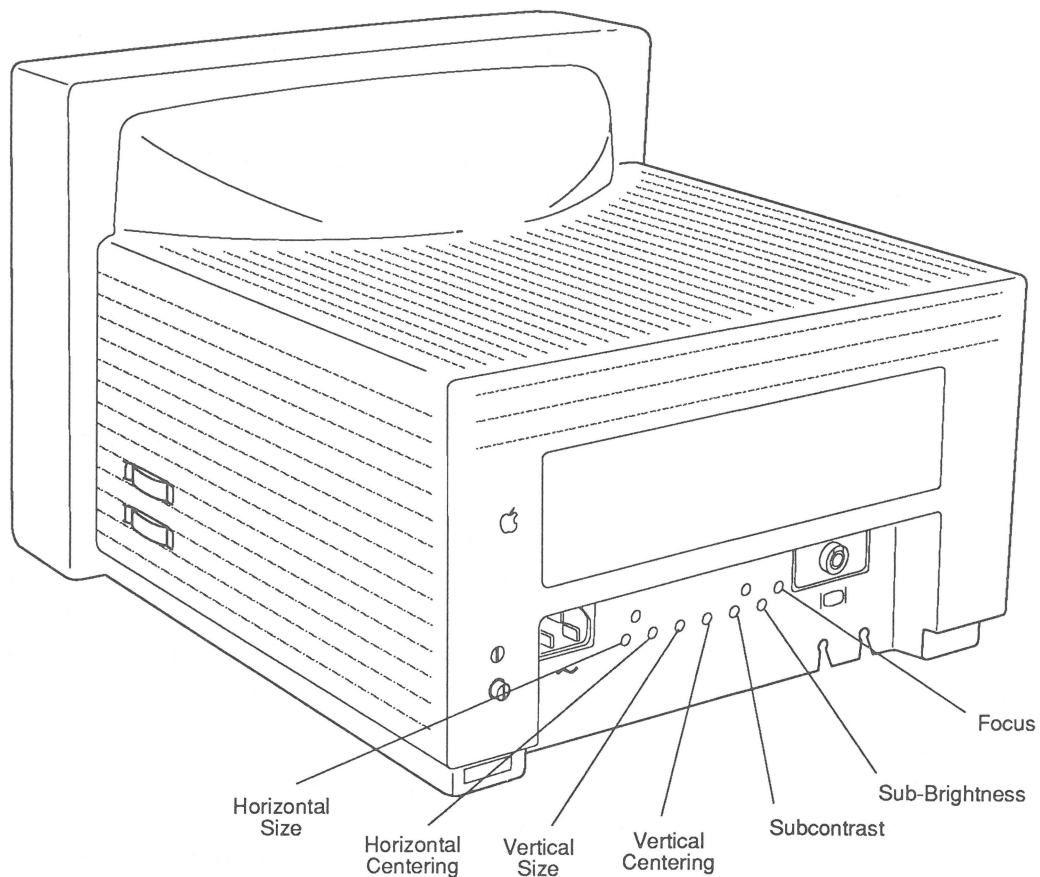


Figure 3-4 Service Adjustment Controls

There will be some interaction between the vertical height and horizontal size adjustments. Set the width first, then set the height. You may need to go back and forth between the two adjustments several times to get them both correct.

Adjusting Vertical Center

1. Using the insulated screwdriver, turn the vertical centering (V.CENT) control (**Figure 3-4**) until the raster is centered (top to bottom) in the bezel.
2. Verify that the raster is $159.5 \text{ mm} \pm 2.5 \text{ mm}$. If it is not, perform the height adjustment again and, if necessary, repeat the vertical center adjustment.

Focus Adjustment

1. Display the Focus Test Pattern on the monitor. To display this pattern see "Macintosh II/IIx Video Test."
2. Set the brightness control to its midrange (detent) position. To identify the midrange position turn the knob until a slight increase in turning resistance is felt. This is the detent position.
3. Set the contrast control at maximum (full clockwise position).
4. Adjust the focus control (**Figure 3-4**) to achieve the best overall focus.

Sub-Brightness Adjustment

1. Set the Control Panel to display 16 Grays on the monitor.
2. Set the contrast control to maximum and the brightness control to its midrange (detent) position.
3. Adjust the sub-brightness control (**Figure 3-4**) until the left bar is black and the next bar to the right is barely visible.

Note: It is possible to adjust the sub-brightness control too high and obtain a screen display where the edges of the scroll bars are displayed in a dashed or irregular pattern. If you see these patterns on the monitor under test, first adjust the sub-brightness control down about a quarter-turn and then perform the sub-brightness adjustment.

Subcontrast Adjustment

1. Set the contrast control to maximum and the brightness control to its midrange (detent) position.
2. Verify that the light meter is functioning properly by pressing the red button on the back of the meter.
3. Move the slide switch so the lower scale reads 10 through 18.
4. Move the lens hood aside to uncover the lens of the meter. Place the lens against the screen at the center, press the Read button, and obtain the light reading on the lower scale.
5. Adjust the subcontrast control (**Figure 3-4**) until the light meter reads in the middle of the "10" scale. This reading should be 33 foot-lamberts.

□ MACTEST MP VIDEO TEST PATTERNS

The *MacTest MP* diagnostic program for the Macintosh IIsi, Macintosh IIfx, and Macintosh LC computers displays test patterns for adjusting the Macintosh 12-Inch Monochrome Display. *MacTest MP* does not diagnose monitor problems; to diagnose monitor problems, refer to Section 4, Troubleshooting.

Materials Required

Macintosh IIsi, Macintosh IIfx, or Macintosh LC
MacTest MP diagnostic disk

Generating the Test Patterns

Follow the steps below to test the video RAM or display the monitor test patterns.

1. Connect the monitor video cable to the Macintosh test station. Connect the monitor's power cable to an AC power outlet.
2. Switch on power to the computer and to the monitor, and insert the *MacTest MP* disk.
3. Open the *MacTest MP* disk icon, and open the *MacTest MP* application icon.

Note: For the Macintosh LC, Apple recommends testing the video RAM installed on the VRAM SIMM before performing the video adjustments.

4. From the main window shown in **Figure 3-5**, deselect any default tests that you do not want to run. Clicking in a box marked with an "x" deselects that test.

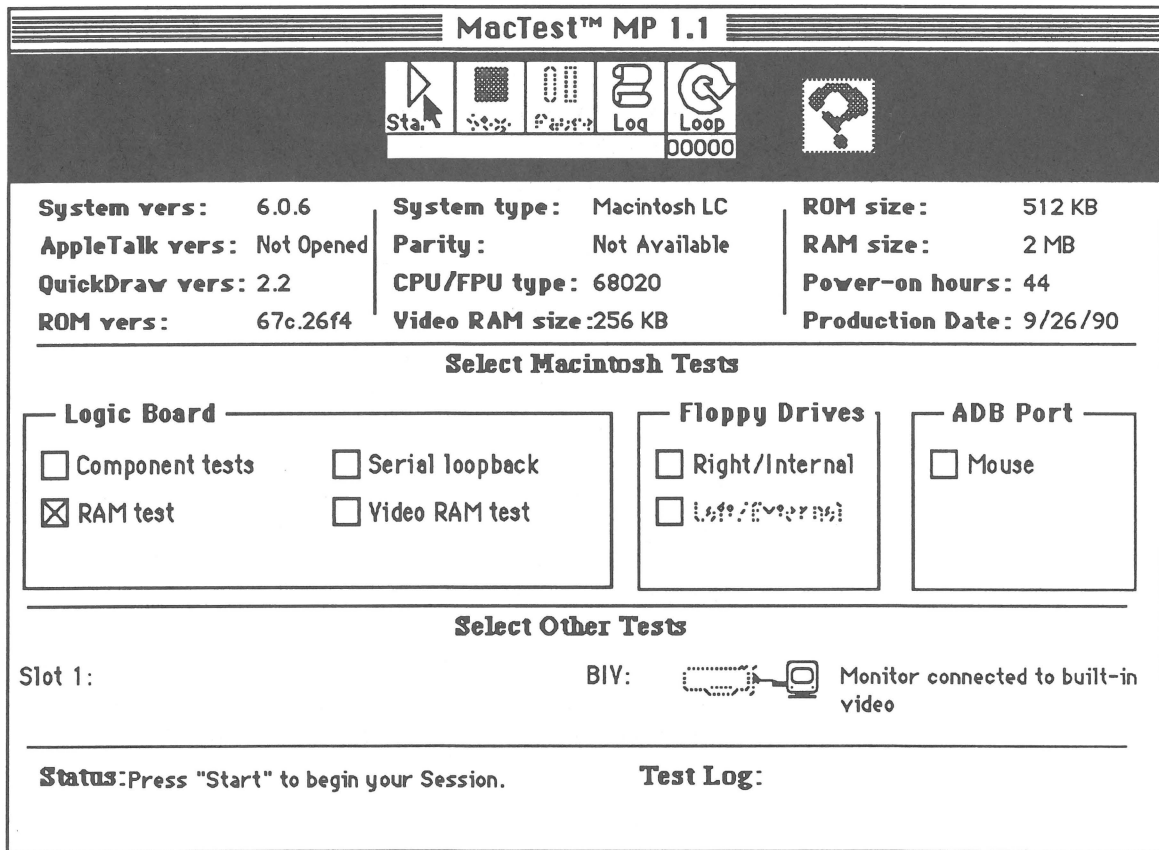


Figure 3-5 MacTest MP Main Window on the Macintosh LC

5. **Figure 3-5.** To test the video RAM on the Macintosh LC, make sure **Video RAM Test** is selected. If the **Video RAM Test** selection box is blank, click on the box to select it.
6. **Figure 3-5** To display the monitor adjustment test patterns, first click on the monitor icon in the main window. The monitor icon is highlighted to indicate its selection.

7. **Figure 3-5.** Click the Start icon at the top of the main window. You will encounter one or both of these scenarios:

- **For the Macintosh LC only:** If you chose to test the video RAM, the screen turns blank. After a few seconds the Status line in the bottom-left corner of the main window indicates whether the VRAM test passed. If the VRAM is OK, the test automatically cycles to the first monitor test pattern.
- If you chose to display only the monitor test patterns, the first (gray bars) test pattern appears. *MacTest MP* displays the test patterns in the order below:
 - Gray Bars
 - Full Black Screen
 - Full White Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

Click the mouse or depress the Space bar to advance through the test patterns (each test pattern appears once). To display a previous pattern, press the dash/hyphen key.

In the forward direction, the main window returns after the focus test pattern. In the reverse direction, you may view as many patterns as you wish.

Macintosh 12-Inch Monochrome Display

Section 4 – Troubleshooting

❏ CONTENTS

- 4.2 Introduction
- 4.2 Symptom Chart

□ INTRODUCTION

This section contains a symptom chart that shows common problems and their solutions. Find the best description of the symptom(s) your defective monitor is displaying; then try the recommended actions in the order listed.

If the first corrective action does not solve the problem, put back the original module or part before you try the next action.

□ SYMPTOM CHART

*No power
(LED does not light)*

1. Check fuse; replace if blown. If it blows again, go to the next step.
2. Replace the main deflection PCB.

No raster

1. Adjust the brightness and contrast knobs.
2. Adjust the sub-brightness control.
3. Check fuse; replace if blown. If it blows again, go to the next step.
4. Replace the main deflection PCB.
5. Replace the contrast/brightness assembly.
6. Replace the CRT.

*One horizontal
line appears
on screen*

1. Ensure that the yoke connectors are tight.
2. Replace the main deflection PCB.
3. Replace the CRT.

*One vertical
raster line
appears*

1. Ensure that the yoke connectors are tight.
2. Replace the main deflection PCB.
3. Replace the CRT.

*Raster not
rectangular*

1. Ensure that all connectors are plugged in correctly.
2. Replace the main deflection PCB.
3. Replace the CRT.

Raster stretched or compressed on side or top of screen

- Replace the main deflection PCB.

Picture breaks in diagonal lines

- Replace the main deflection PCB.

Raster size small; picture abnormally bright

1. Ensure that the yoke connectors are tight.
2. Replace the main deflection PCB.
3. Replace the CRT.

Picture rolls vertically

- Replace the main deflection PCB.

Raster cannot be centered

1. Adjust the horizontal hold.
2. Replace the main deflection PCB.
3. Replace the CRT.

Brightness cannot be adjusted

1. Replace the contrast/brightness assembly.
2. Replace the main deflection PCB.
3. Replace the CRT.

Picture jitters

1. Confirm that the grounding cables are attached to the chassis.
2. Confirm that the computer is grounded correctly.
3. Replace the main deflection PCB.

Black spots on screen (burnt phosphor)

- Replace the CRT.

Image is too dark or too bright

1. Adjust the brightness knob.
2. Adjust the sub-brightness control.
3. Replace the main deflection PCB.
4. Replace the CRT.

Focus cannot be adjusted

1. Replace the main deflection PCB.
2. Replace the CRT.

*Flashing lines
on screen*

1. Confirm the contact of the video connector to the neck of the CRT.
2. Replace the contrast/brightness assembly.
3. Replace the main deflection PCB.

*Raster higher on
one side than
the other*

1. Replace the main deflection PCB.
2. Replace the CRT.

Macintosh 12-Inch Monochrome Display

Illustrated Parts List

❑ CONTENTS

IPL.3 Exploded View – Macintosh 12-Inch Monochrome
Display Subassemblies (Figure 1)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Macintosh 12-Inch Monochrome Display, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

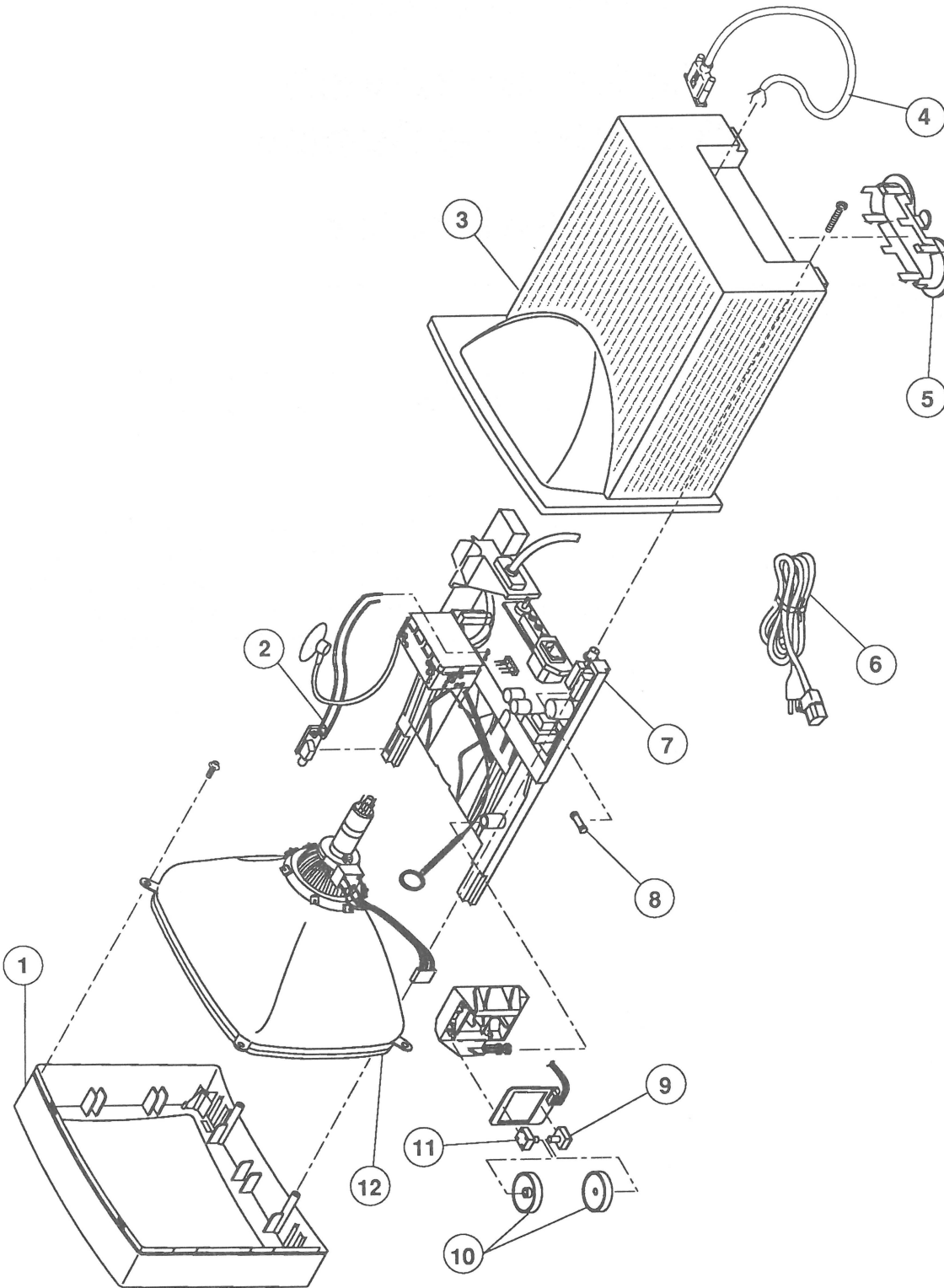


FIGURE 1

**❑ EXPLODED VIEW – MACINTOSH 12-INCH MONOCHROME
DISPLAY SUBASSEMBLIES (Figure 1)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	658-8351	Plastic Case Bezel
2	630-0004	Cable Assembly, LED
3	658-8352	Plastic Rear Cover
4	590-4510	Cable Assembly, CPU-to-Monitor
5	815-1156	Cable Storage Bobbin
6	590-0380	Cable, External Power Hi-Res
	590-0420	Cable, External Power, European
7	661-0615	Main Deflection Board
8	941-5220	Fuse, 1 Amp, 250 V
9	109-1020	Pot, 10 K Ω , 0.15 W Contrast
10	956-0023	Screw/Knob Set
11	109-1022	Pot, 10 K Ω , 0.15 W CC Brightness
12	076-0382	CRT Assembly, Domestic & Europe (etched)
	076-0383	CRT Assembly, Australia

Macintosh 12-Inch RGB Display

Technical Procedures

□ TABLE OF CONTENTS

Section 1 – Basics	1.3	Product Description
	1.3	External Controls
	1.5	Module Identification
	1.6	Care and Handling
 Section 2 – Take-Apart	 2.3	 Rear Cover
	2.5	Discharging the Cathode-Ray Tube (CRT)
	2.5	Discharge Procedure
	2.7	Anode Cap
	2.9	Contrast/Brightness Assembly
	2.11	Fuse
	2.11	CRT Video Board
	2.19	External Power Cable (Domestic Only)
	2.21	CPU-to-Monitor Cable
	2.23	Main Deflection Board
	2.27	Plastic Main Board Holder
	2.29	CRT Assembly
	2.31	LED Assembly with Cable
	2.32	Bezel
 Section 3 – Adjustments	 3.2	 Introduction
	3.3	Safety Instructions
	3.5	Live Adjustment Rules
	3.5	Location of Controls
	3.5	User Controls
	3.5	External Service Controls
	3.7	Internal Service Controls
	3.8	MacTest Test Patterns
	3.8	Generating the Test Patterns
	3.11	Adjustment Procedures
	3.11	Materials Required
	3.11	Screen Adjustment
	3.17	Vertical Size
	3.17	Vertical Center

...Continued on next page

Section 3 – Adjustments (continued)	3.17	Horizontal Center
	3.19	Horizontal Size
	3.21	Vertical Linearity
	3.21	Vertical Hold
	3.21	Horizontal Hold
	3.21	Focus
	3.23	White Balance
	3.27	Using a Light Meter to Measure Luminance

Section 4 – Troubleshooting	4.2	Introduction
	4.3	Monitor Inspection
	4.4	Geometric Alignment Chart
	4.5	Symptom Chart

Illustrated Parts List	IPL.3	CRT Assembly (Figure 1)
	IPL.5	Internal Assembly (Figure 2)

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Macintosh 12-Inch RGB Display

Section 1 – Basics

□ CONTENTS

1.3	Product Description
1.3	External Controls
1.5	Module Identification
1.6	Care and Handling

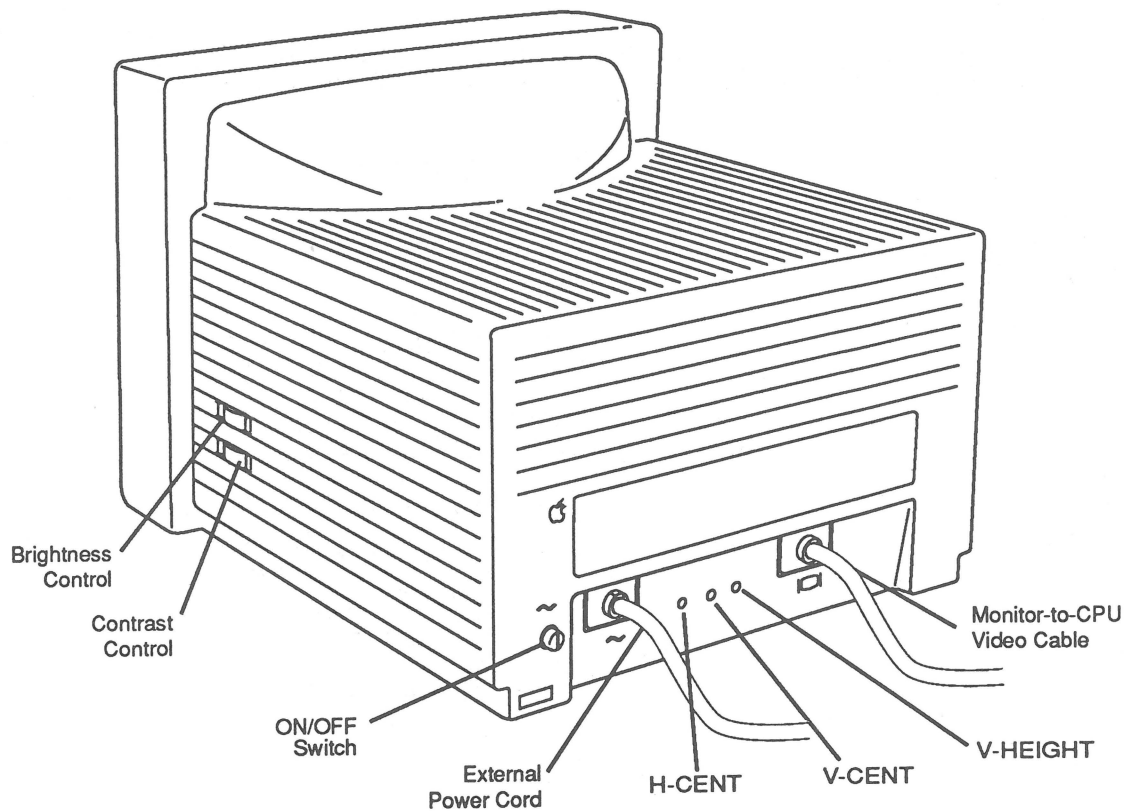


Figure 1-1 External Controls (Domestic Version Shown)

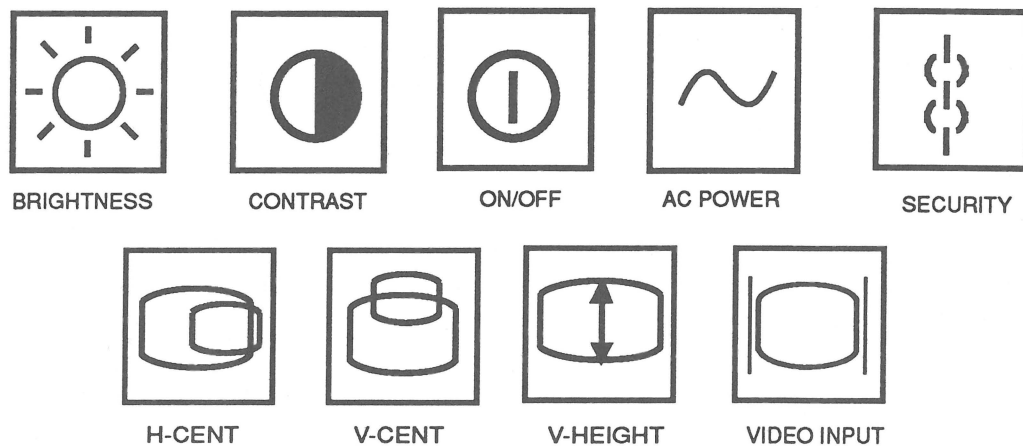


Figure 1-2 International Symbols

□ PRODUCT DESCRIPTION

The Macintosh® 12-Inch RGB Display is a reduced-cost RGB monitor. The monitor receives individual red, green, and blue analog input and synchronization signals via the video circuitry of Macintosh systems with built-in video circuitry, or via an installed video card.

The 12-Inch RGB Display features a flicker-free display and 64 DPI (dots per inch) resolution. It also features:

- 512 horizontal by 384 vertical pixels
- 60-Hz refresh rate
- 256 colors displayed with the 8-bit, built-in video circuitry of the Macintosh IIsi and Macintosh LC
- Compatibility with the Macintosh Display Cards:
 - Macintosh Display Card 4•8 (displays 256 colors)
 - Upgraded (1 MB of video RAM) Macintosh Display Card 4•8, and Macintosh Display Card 8•24 (display 16 million colors)
- Nondetachable monitor-to-CPU video cable
- Nondetachable external power cable (domestic version only)
- Design compatibility with the Macintosh IIfx, Macintosh IIsi, and Macintosh LC systems

External Controls

Figure 1-1. The ON/OFF switch, brightness control, and contrast control are the only controls recommended for user access. The brightness and contrast controls are located on the side of the case, and the ON/OFF switch is at the back of the monitor. The brightness control has a detent for midrange reference.

The three adjustment controls listed below are located at the back of the 12-Inch RGB Display. The user manual warns owners not to touch these controls, but well-meaning users will sometimes misalign them.

- H-CENT
- V-CENT
- V-HEIGHT

The internationally recognized symbols for the external controls are shown in **Figure 1-2.**

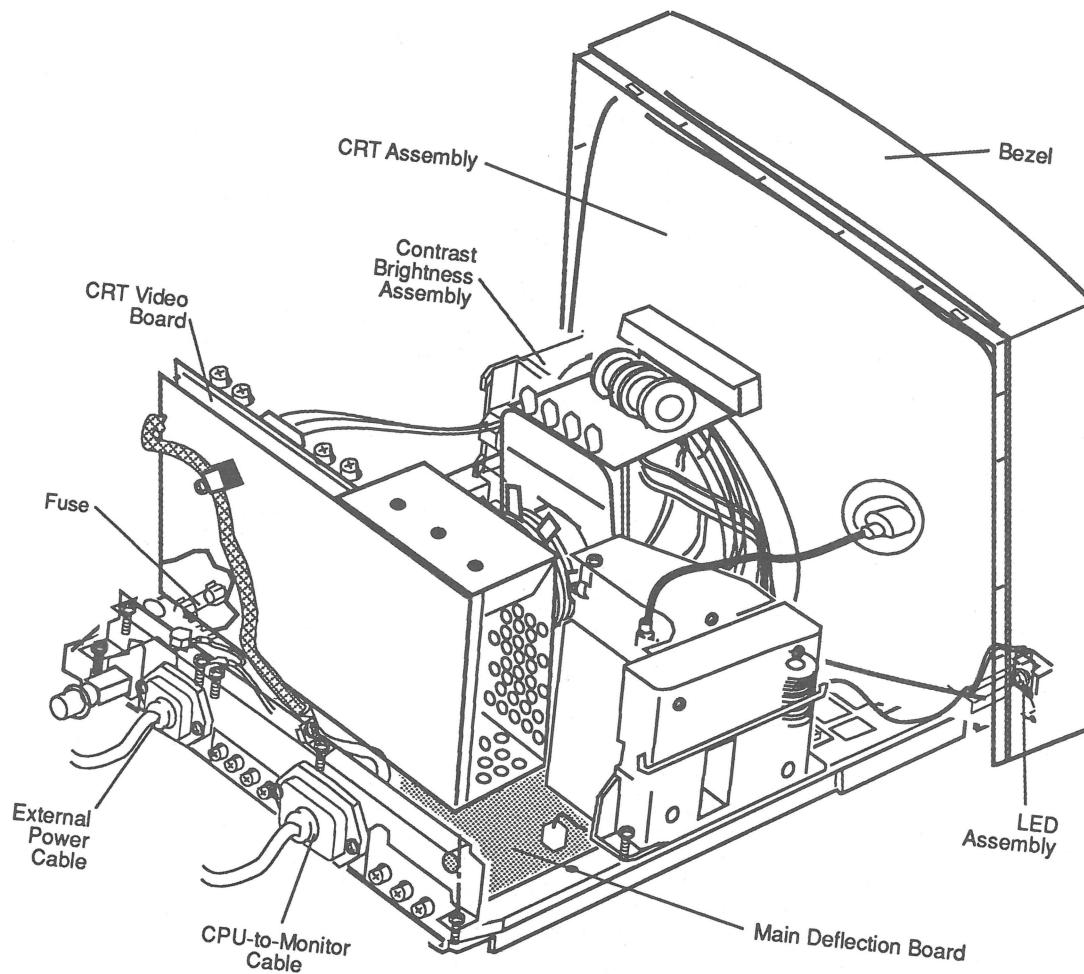


Figure 1-3 Exchange Modules & Replaceable Parts (Domestic Version Shown)

□ MODULE IDENTIFICATION

The Macintosh 12-Inch RGB Display has been designed to be easy to service and maintain. All exchange modules and replaceable parts are easily accessed, and no new repair or adjustment tools are required. All of the internal adjustment controls are easily accessed with the rear cover removed.

Figure 1-3. The 12-Inch RGB Display includes the following exchange modules and replaceable parts:

- CRT assembly
- LED assembly
- CRT video board
- CPU-to-monitor cable
- External power cable
- Main deflection board
- Fuse
- Contrast/brightness assembly
- Bezel

Note: International versions exist for all of the exchange modules and replaceable parts listed above *except* the LED assembly and bezel. Note that the international version of the external power cord is detachable and the international main deflection board includes a universal power supply and male power connector on the board.

IMPORTANT: *Removing the CRT video board requires desoldering the flyback transformer cable from connector Q201 (see Section 2, Take-Apart). Connector Q201 is isolated from the other connectors on the CRT video board by a white plastic cover. When removing and replacing the CRT video board, take care not to damage this cable and connection.*

□ CARE AND HANDLING

The Macintosh 12-Inch RGB Display is a complex precision instrument that must be handled with great care to ensure perfect operation. Dropping the monitor even one inch can jar the CRT permanently out of alignment.

The 12-Inch RGB Display contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), then explode.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the You Oughta Know tab.

Use care when cleaning the CRT screen and tube. Wipe the tube (the back of the CRT) only with a dry, lintless cloth. Cleaning solutions and even water can destroy the protective insulating coating that surrounds the anode ring, and can attack the external conductive coating. You can use a mild cleaning solution to clean the CRT screen, but **do not apply the cleaning solution directly to the screen**. Apply the solution to a soft cloth, and use the cloth to clean the screen.

Keep service modules and finished-goods monitors in the Apple® packaging until use, and return modules to Apple for repair packed in approved module packaging.

Macintosh 12-Inch RGB Display

Section 2 – Take-Apart

□ CONTENTS

2.3	Rear Cover
2.5	Discharging the Cathode-Ray Tube (CRT)
2.5	Discharge Procedure
2.7	Anode Cap
2.9	Contrast/Brightness Assembly
2.11	Fuse
2.11	CRT Video Board
2.19	External Power Cable (Domestic Only)
2.21	CPU-to-Monitor Cable
2.23	Main Deflection Board
2.27	Plastic Main Board Holder
2.29	CRT Assembly
2.31	LED Assembly with Cable
2.32	Bezel

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

Note: For ease of illustration, the domestic version of the Macintosh 12-Inch RGB Display is shown throughout the Take-Apart procedures. Keep in mind that the international version of the 12-Inch RGB Display includes a detachable external power cable.

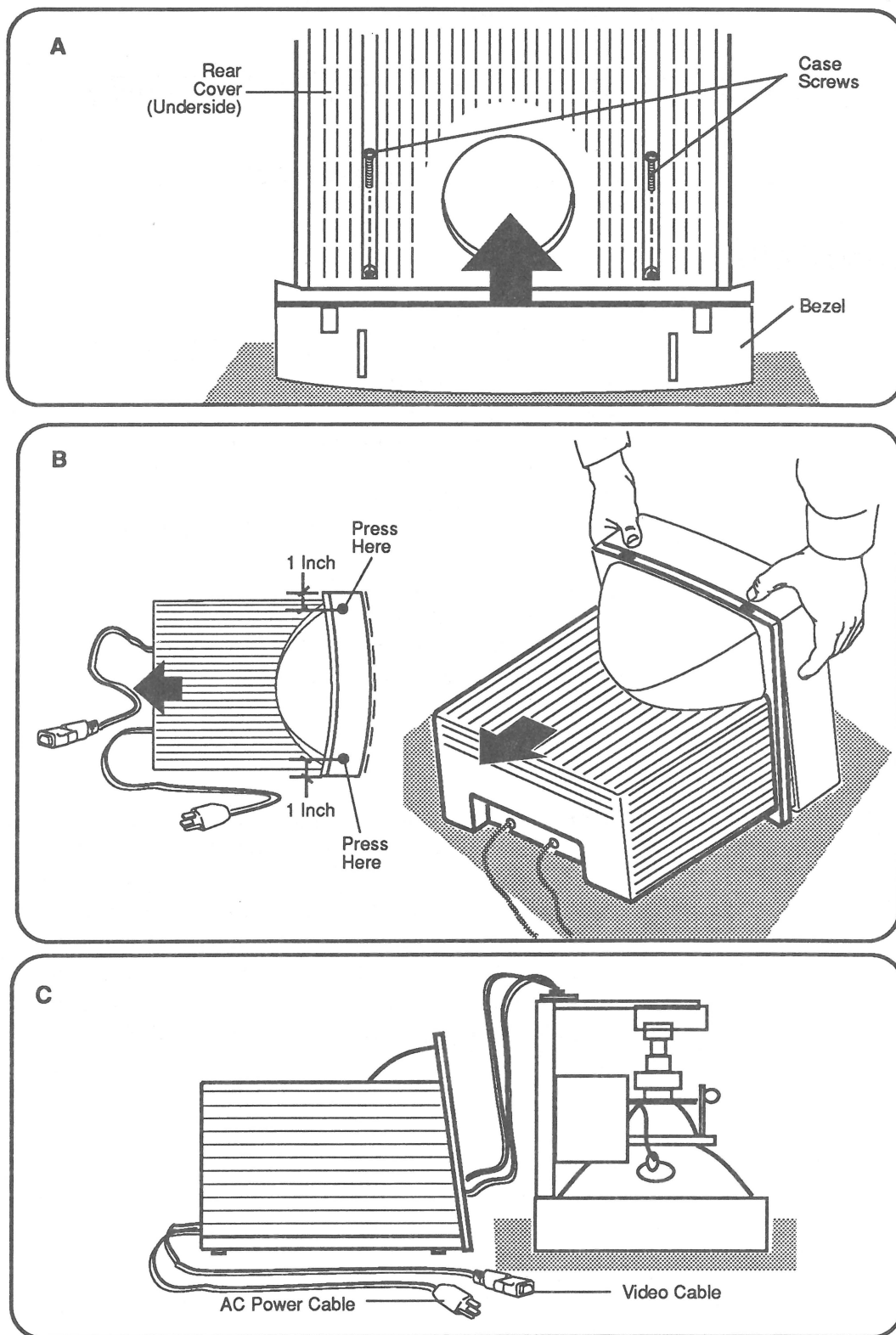


Figure 2-1 Removing the Rear Cover

□ REAR COVER

WARNING: *The Macintosh 12-Inch RGB Display contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the You Oughta Know tab before you remove the cover. Failure to follow the safety rules could result in serious injury.*

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off monitor power. Disconnect the AC power cord from the power outlet, and disconnect the video cable from the Macintosh computer.
2. Gently place the monitor face-down on a soft, protective surface.
3. **Figure 2-1A.** Remove the two case screws, and separate the back of the rear cover from the bezel.
4. **Figure 2-1B.** Set the monitor upright. Disengage the top of the rear cover from the bezel by pressing down one inch from the outside edges of the bezel as shown in **Figure 2-1B**.
5. **Figure 2-1C.** Gently place the monitor face-down on the protective surface. Lift off the rear cover and place it on the protective pad. Pull the AC power cord and video cable through the cover.

Replace

1. Carefully set the monitor face down on a soft, protective surface.
2. **Figure 2-1C.** Insert the AC power cord and video cable through the mounting holes in the rear cover.
3. Slide the rear cover over the monitor chassis and press it snugly onto the bezel. The top of the cover will snap into place on the bezel.
4. **Figure 2-1A.** Replace the two case screws, and set the monitor upright.

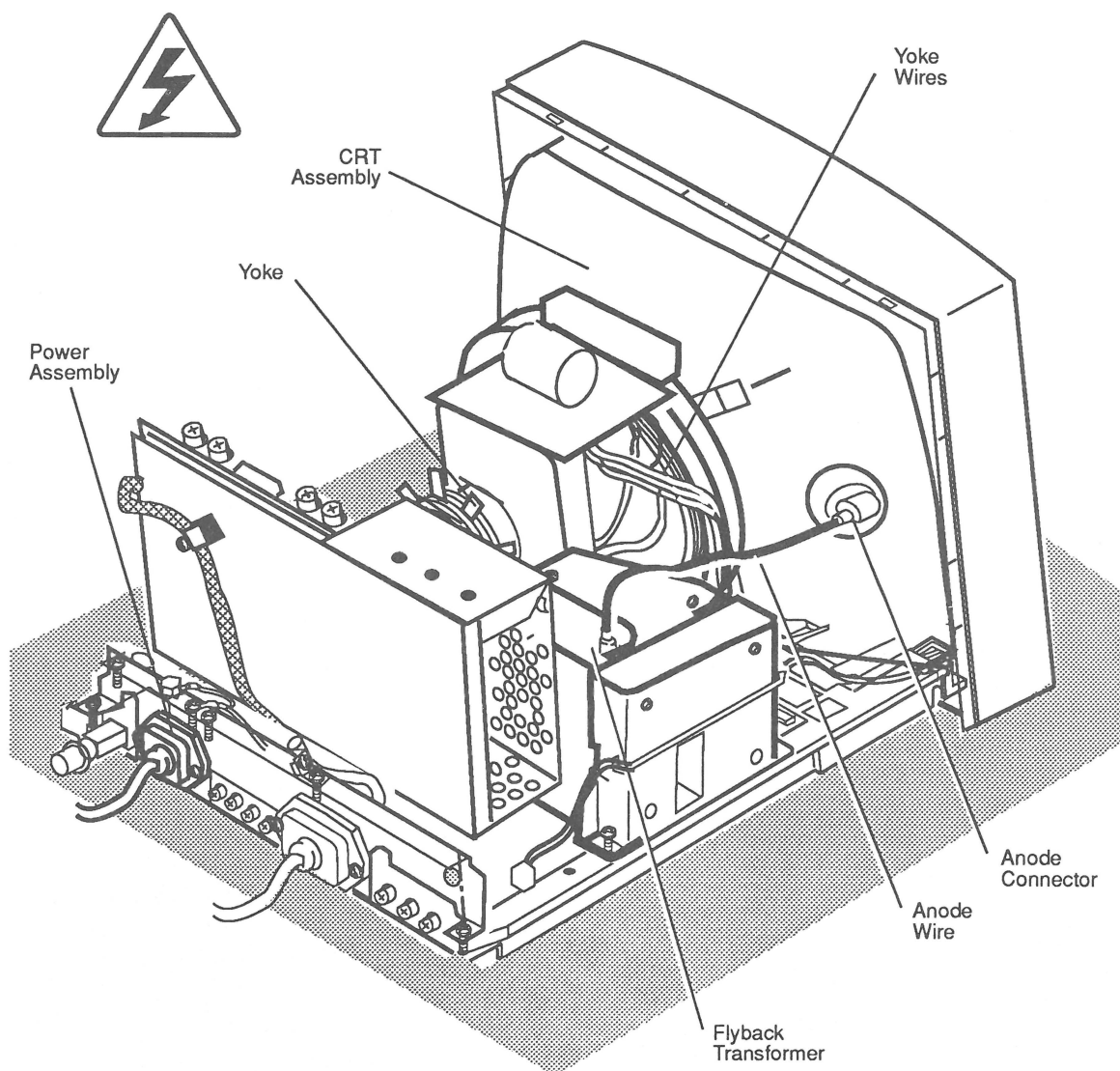


Figure 2-2 CRT High-Voltage Areas

□ DISCHARGING THE CATHODE-RAY TUBE (CRT)

The Macintosh 12-Inch RGB Display contains a bleeder resistor that automatically drains the charge from the CRT when power is off. **Follow the discharge procedure below to ensure your safety in the event that the resistor failed and the anode is still charged.**

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, **CRT Safety**, under the **You Oughta Know** tab. Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are also given in that section.

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**

WARNING: To prevent serious injury, do not touch the rear of the CRT, the yoke wires, the anode connector or anode wire, the flyback transformer, or the rear of the power inlet. These dangerous areas are shown in **Figure 2-2**.

2. Remove the rear cover.
3. Set the monitor upright on the ungrounded protective pad, with the back facing you.

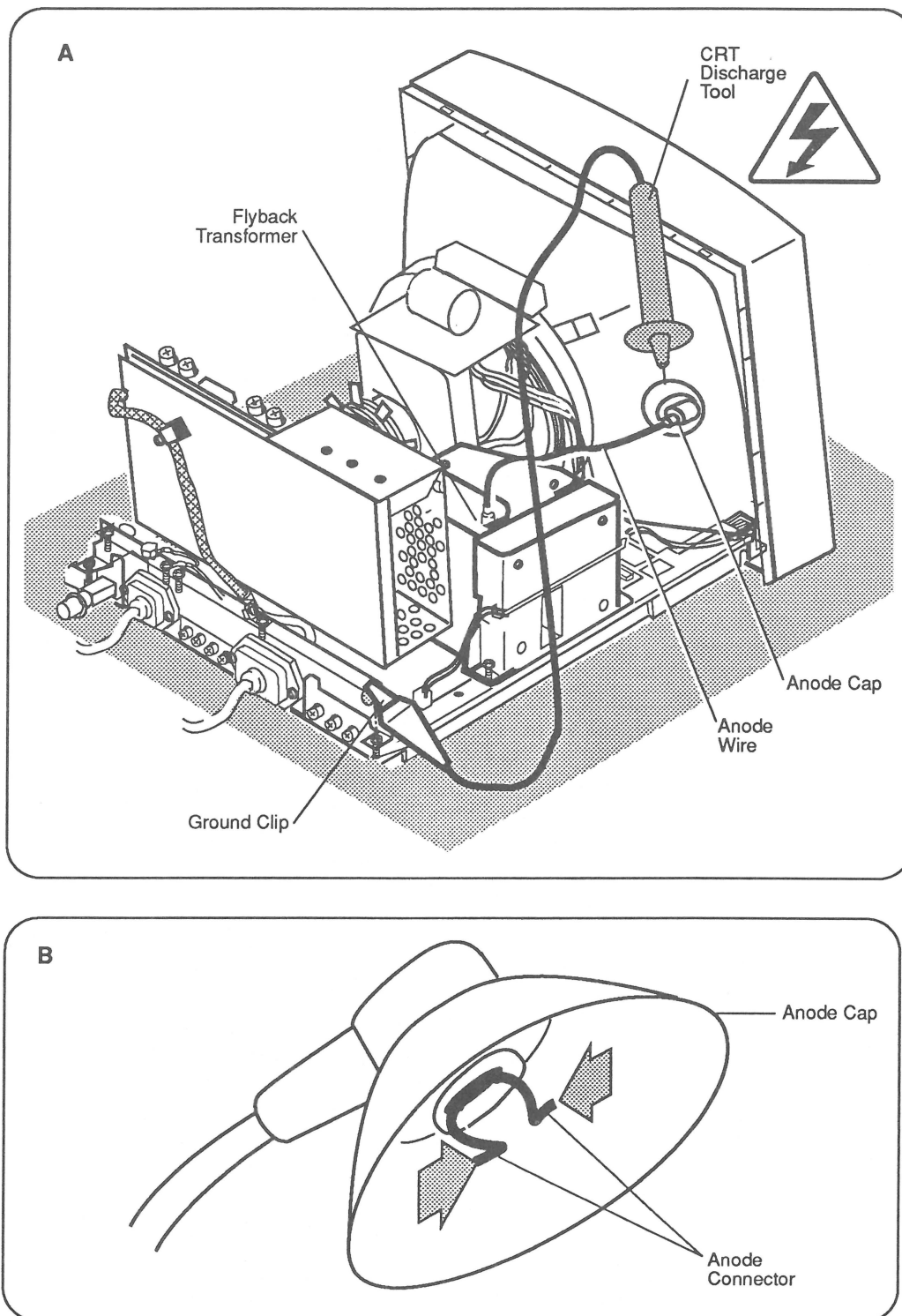


Figure 2-3 Discharging the Cathode-Ray Tube

4. **Figure 2-3A.** Attach the ground clip of the CRT discharge tool to any metal part of the chassis.

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

5. Put one hand behind your back. Grasp the handle of the discharge tool with your other hand. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap until the probe touches the anode ring.
6. Remove the probe of the CRT discharge tool from under the anode cap and detach the ground clip from the metal chassis.

Note: If the bleeder resistor fails, a secondary charge could build up over a period of time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the metal chassis and the other end to the anode aperture.

Anode Cap

Figure 2-3B. For some procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode connector at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, then press down around the edges of the rubber anode cap to ensure a firm seal.

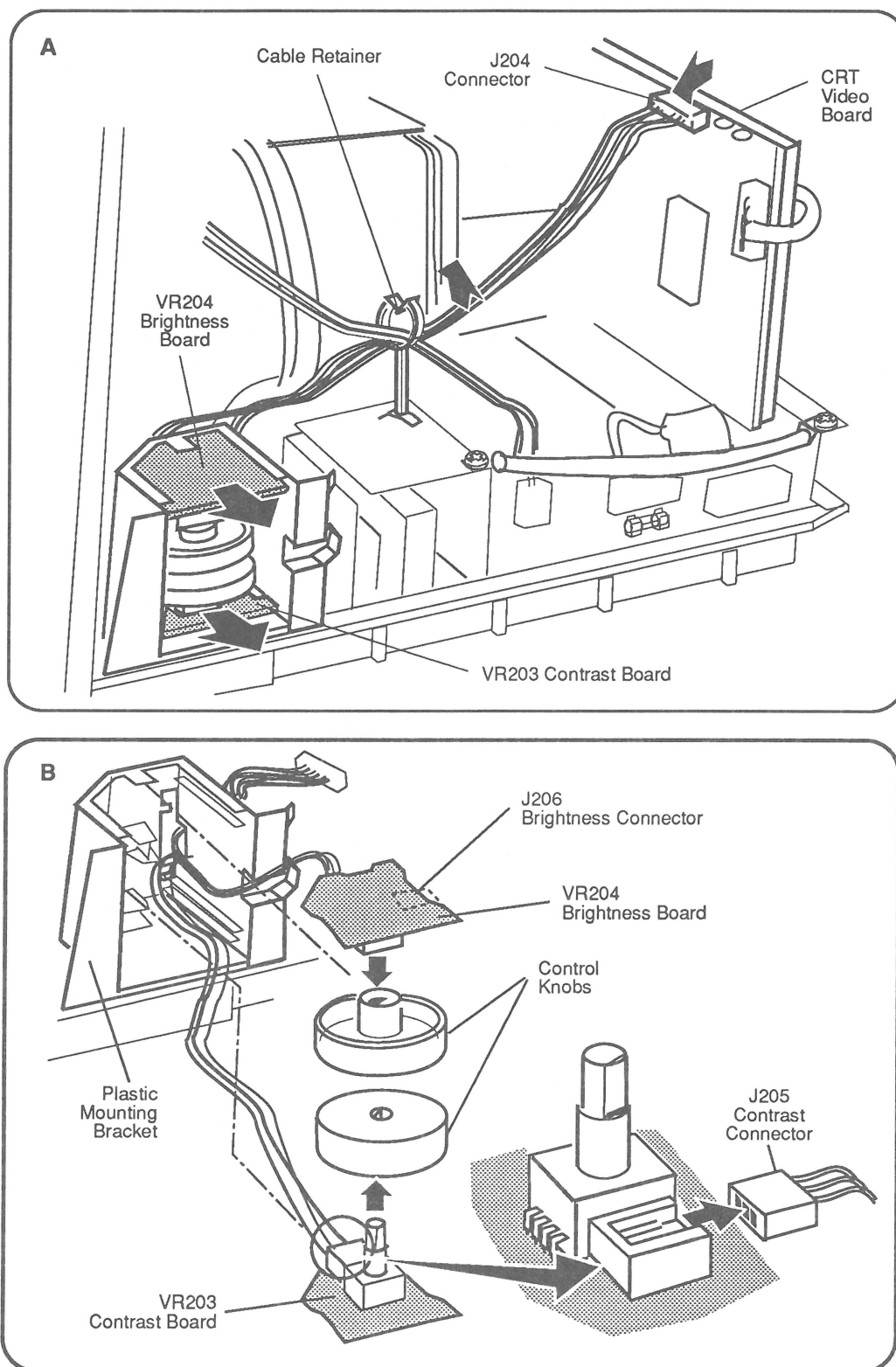


Figure 2-4 Removing the Contrast/Brightness Assembly

□ CONTRAST/BRIGHTNESS ASSEMBLY

Remove

1. Remove the rear cover and discharge the CRT.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. **Figure 2-4A.** Disconnect the six-wire cable connector from connector **J204** on the CRT video board. Remove the six wires from the cable retainer.
4. **Figure 2-4A.** Remove brightness board **VR204** and contrast board **VR203** from the mounting bracket. Unhook and pull the six wires through the back of the mounting bracket.
5. **Figure 2-4B.** Remove the two plastic control knobs, and save them to put on the replacement boards.
6. **Figure 2-4B.** Disconnect cable connector **J206** from brightness board **VR204**, and cable connector **J205** from contrast board **VR203**.

Replace

1. **Figure 2-4B** Connect cable connector **J205** to the new contrast board **VR203**, and cable connector **J206** to the new brightness board **VR204**.
2. **Figure 2-4B.** Install the customer's two control knobs on the replacement contrast and brightness boards.
3. **Figure 2-4A.** Insert cable connector **J204** through the back of the plastic mounting bracket, and install contrast board **VR203** in the lower slot, and brightness board **VR204** in the upper slot. Hook the six connector wires to the back of the mounting bracket and the cable retainer.
4. **Figure 2-4A.** Connect the six-wire cable connector to connector **J204** on the CRT video board.
5. Replace the rear cover.
6. Make sure the monitor is adjusted correctly. Perform the "Monitor Inspection" procedure found in Section 4, Troubleshooting.

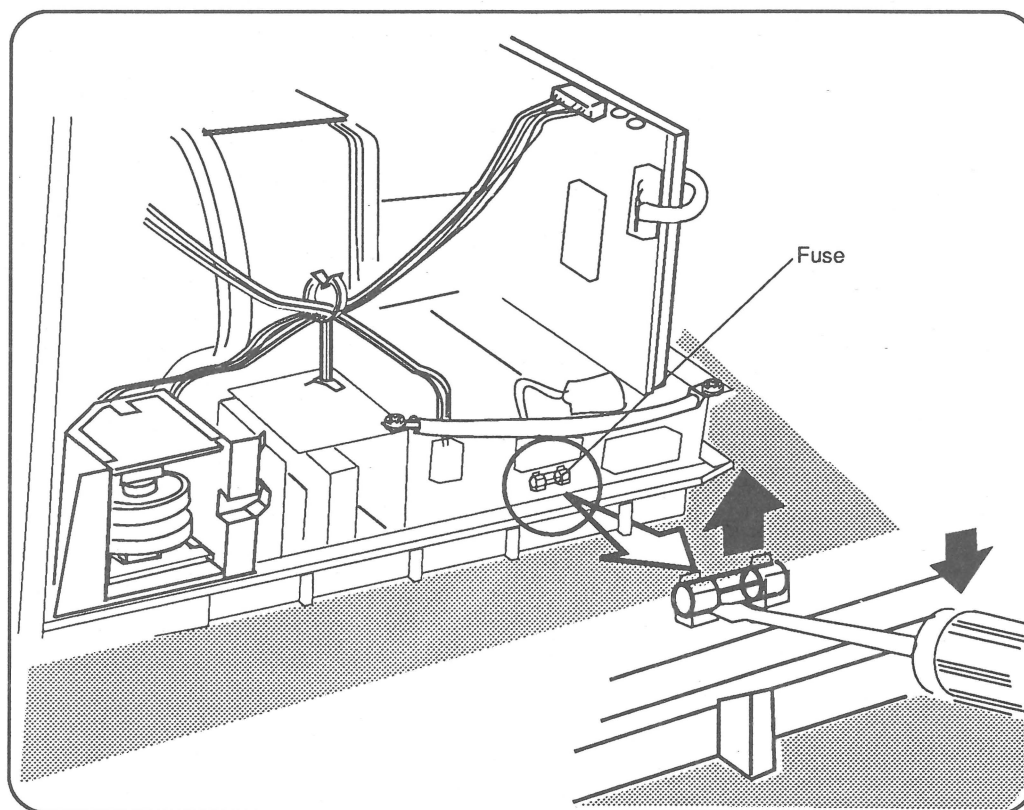


Figure 2-5 Removing the Fuse

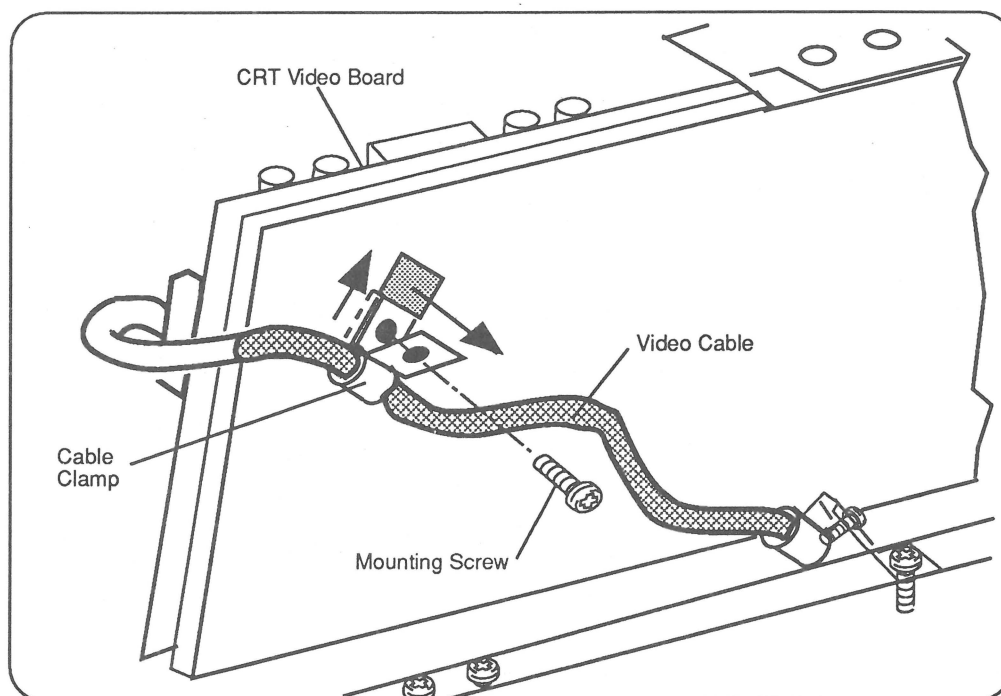


Figure 2-6 Removing the Video Cable from the CRT Video Board

□ FUSE

Materials Required

Small, flat-blade screwdriver

Remove

1. Remove the rear cover and discharge the CRT.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. **Figure 2-5.** Using the small flat-blade screwdriver, pry the defective fuse out of connector **F901** on the main deflection board.

Replace

1. **Figure 2-5.** Install a new fuse in connector **F901** on the main deflection board.
2. Replace the rear cover.

□ CRT VIDEO BOARD

Materials Required

Small and medium Phillips screwdrivers
Low-wattage soldering iron

Remove

1. Remove the rear cover and discharge the CRT.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. **Figure 2-6.** Remove the screw that secures the video cable to the cable clamp at the back of the CRT video board. Remove the video cable from the clamp, and remove the clamp from the video board.

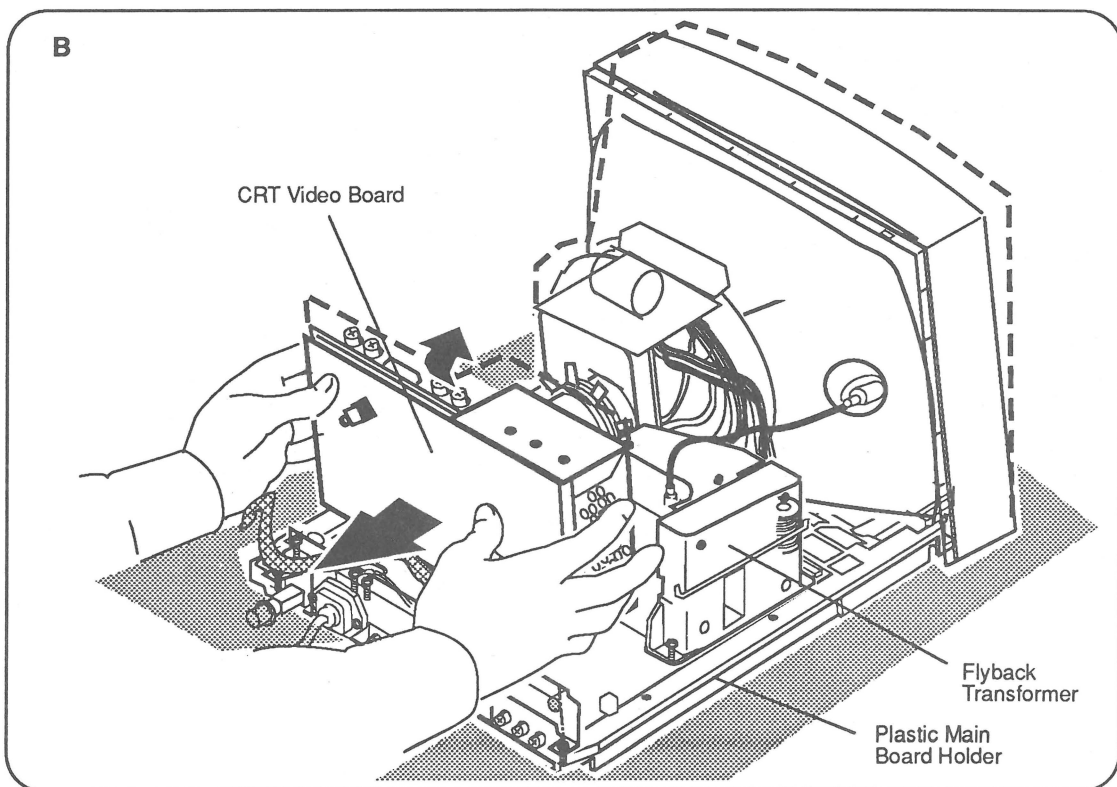
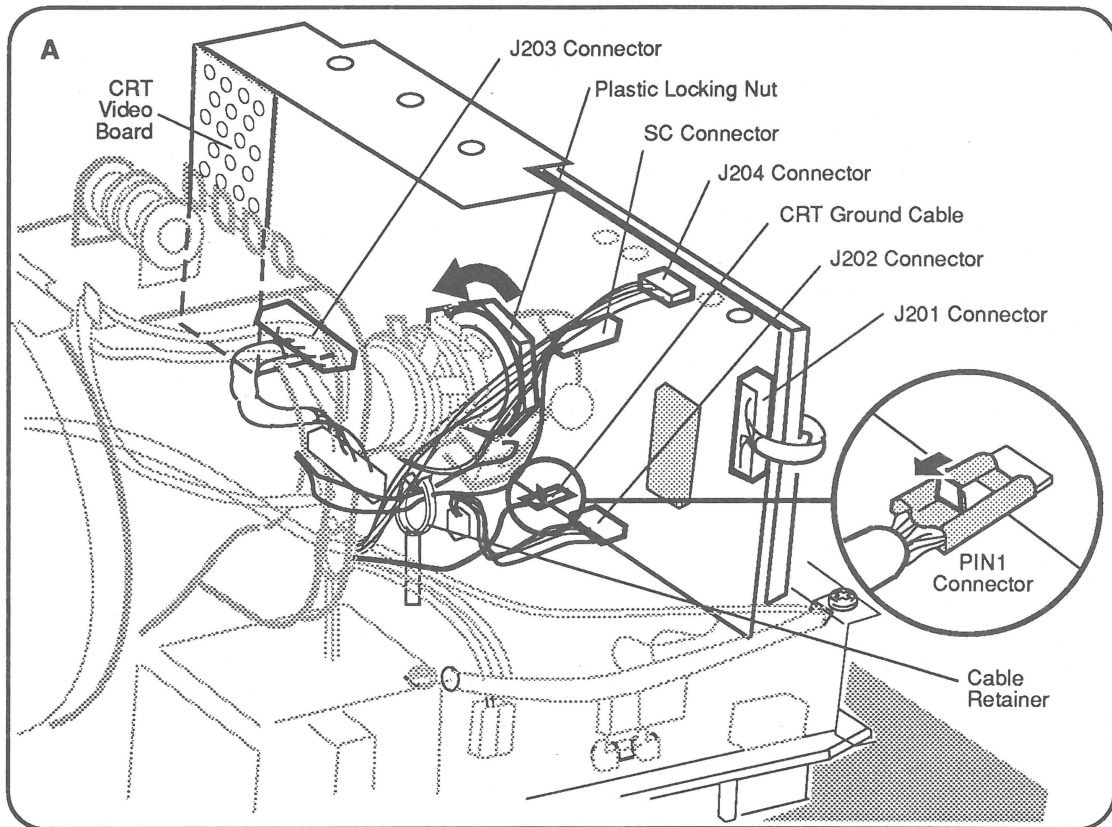


Figure 2-7 Removing the CRT Video Board

4. **Figure 2-7A.** Disconnect the following cable connectors from the CRT video board:

- 6-wire cable connector from connector **J204**
- 8-wire video connector from connector **J201**
- Single-pin connector from connector **SC**
- 5-wire, 7-pin connector from connector **J202**
- 6-wire, 8-pin connector from connector **J203**

Note: To unhook the CRT ground cable, you must first depress the small metal catch in the center of the connector as shown in the detail to **Figure 2-7A**.

5. **Figure 2-7A.** Disconnect the CRT ground cable from connector **PIN1** on the CRT video board.
6. **Figure 2-7A.** Remove the two cables from the cable retainer on the main deflection board beneath the neck of the CRT.
7. **Figure 2-7A.** Loosen (turn clockwise, as viewed from the rear of the monitor) the plastic locking nut on the neck of the CRT.

IMPORTANT: *The CRT assembly must be tilted up slightly (see **Figure 2-7B**) in order to remove the video board over the rear metal chassis. There is sufficient play in the plastic main board holder to tilt up the CRT without fear of breakage.*

8. **Figure 2-7B.** Grasp the back of the CRT video board with both hands, and pull the board straight back off the neck of the CRT. **Note that a cable still connects the CRT video board to the flyback transformer.**

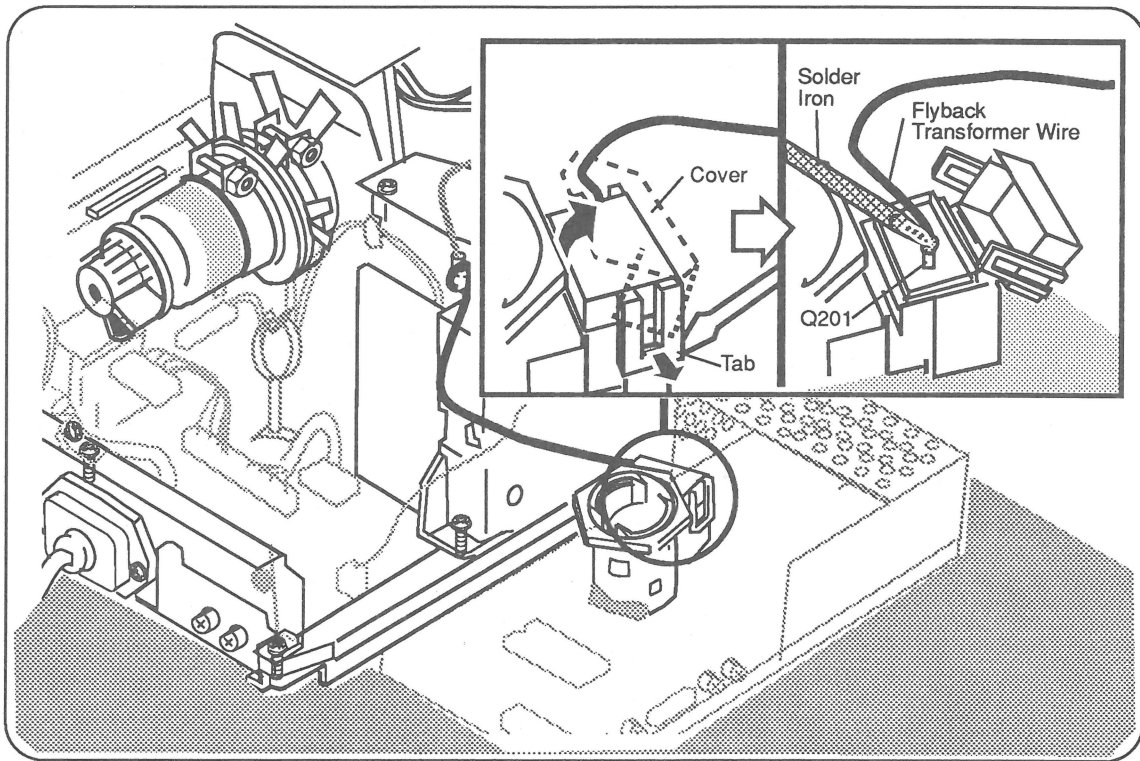


Figure 2-8 Desoldering the CRT Video Board

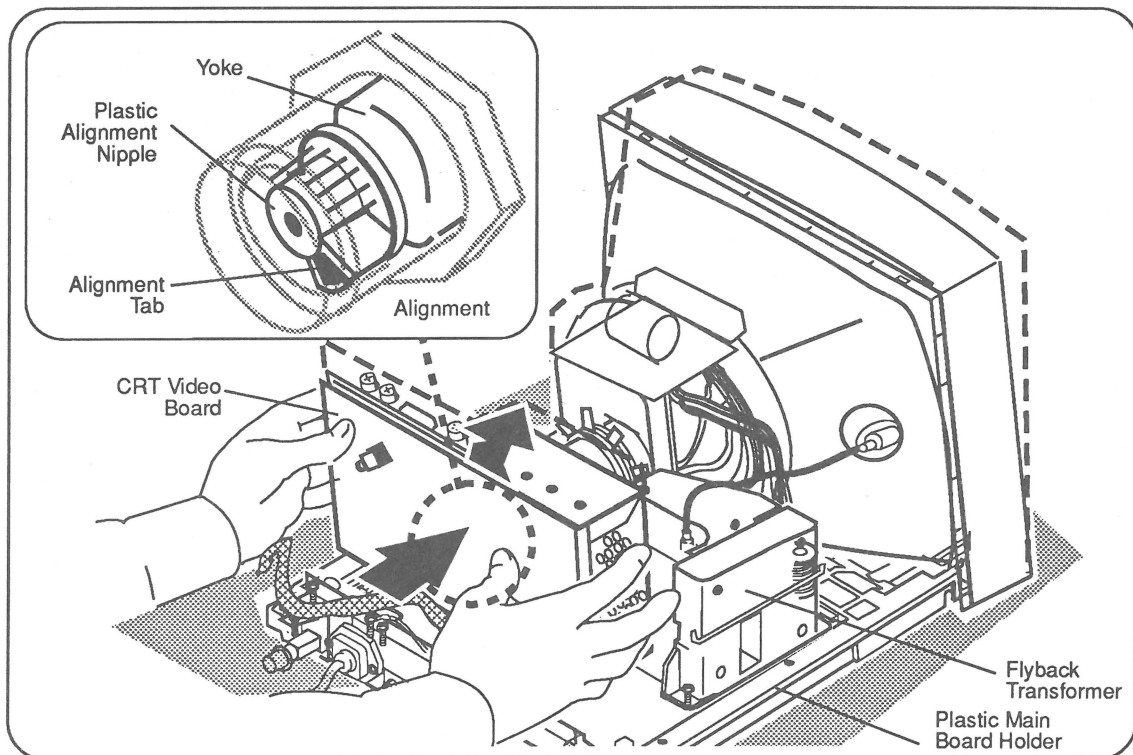


Figure 2-9 Installing the CRT Video Board

9. **Figure 2-8.** Place the CRT video board on the protective mat next to the flyback transformer.
10. **Figure 2-8.** Unfasten the two side tabs and open the white plastic cover over connector **Q201**. You may need to use a small flat-blade screwdriver to open the tabs on the side of the cover.

CAUTION: To avoid damaging the CRT video board or components on the board, be sure to use a low-wattage soldering iron and to contact only the connector **Q201** terminal with the soldering iron.

11. **Figure 2-8.** Using the low-wattage soldering iron, desolder the flyback transformer cable from connector **Q201**.

Replace

1. **Figure 2-8.** Unfasten the two side tabs and open the white plastic cover over connector **Q201**.

CAUTION: To avoid damaging the CRT video board or components on the board, be sure to use a low-wattage soldering iron and to contact only the connector **Q201** terminal with the soldering iron.

2. **Figure 2-8.** Using the low-wattage soldering iron, solder the flyback transformer cable to connector **Q201**.

IMPORTANT: The CRT assembly must be tilted up slightly (see **Figure 2-9**) in order to install the video board over the rear metal chassis. There is sufficient play in the plastic main board holder to tilt up the CRT without fear of breakage.

3. **Figure 2-9.** Position the CRT video board behind the plastic alignment nipple on the neck of the CRT assembly. Align the notched groove in the CRT connector with the alignment tab on the plastic nipple. Using both hands, push the CRT video board squarely onto the neck of the CRT.

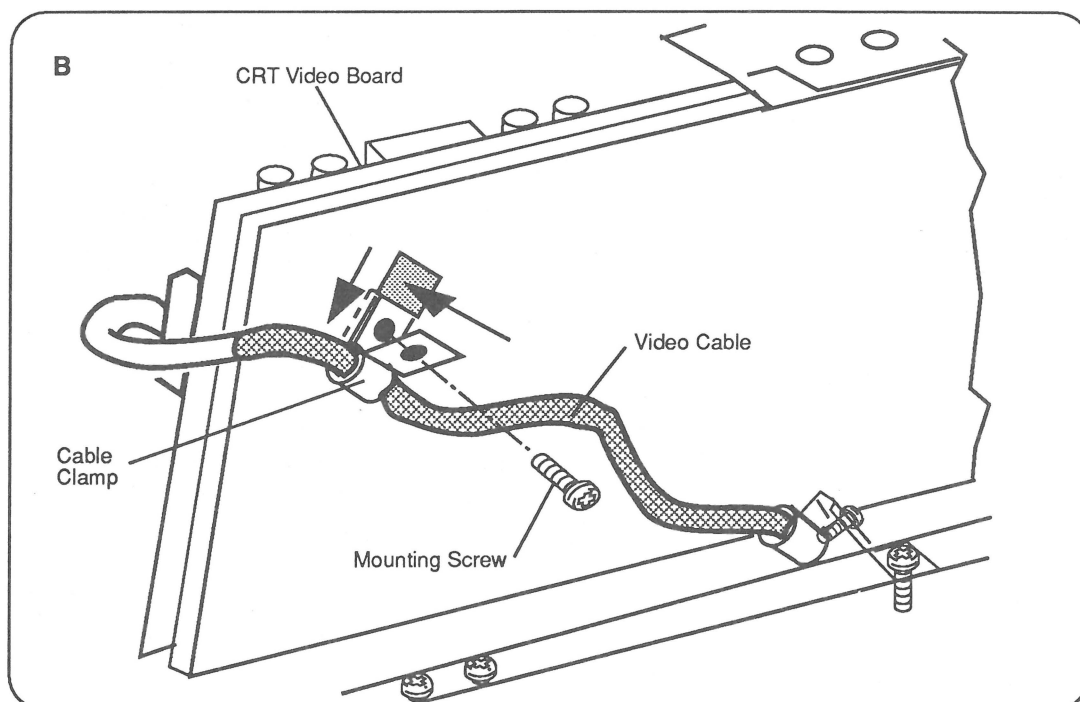
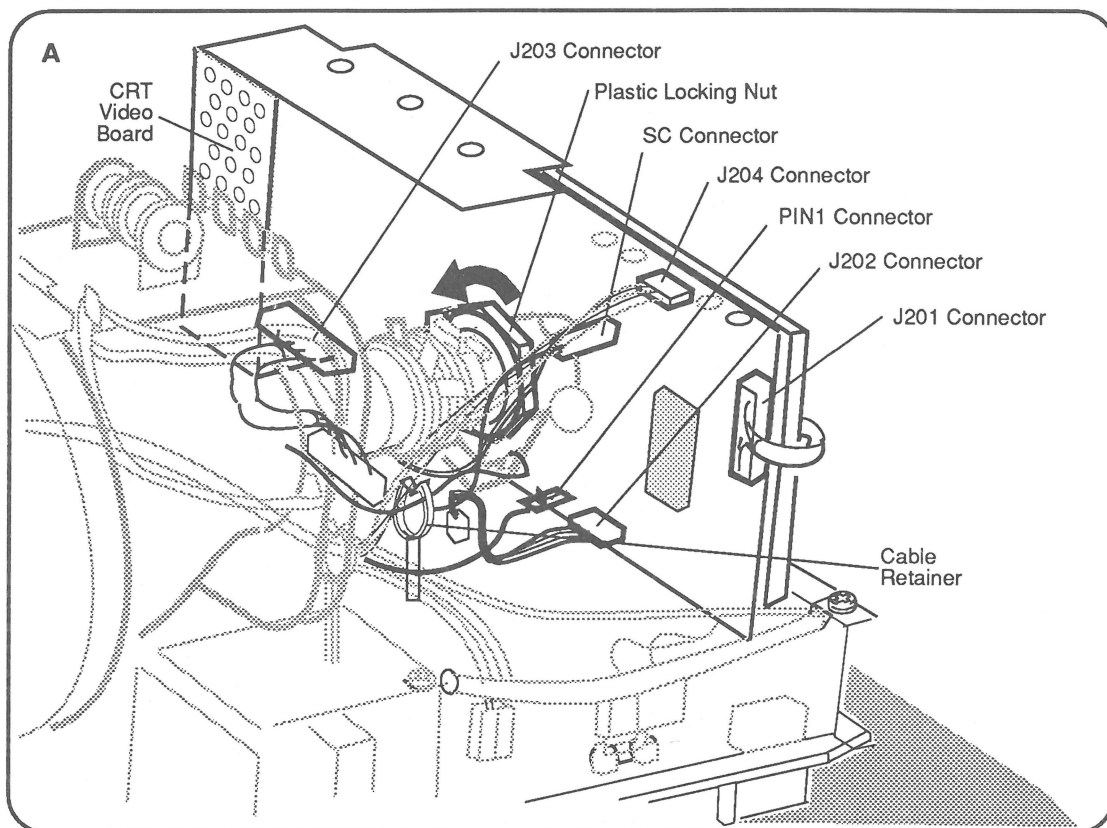


Figure 2-10 Installing the CRT Video Board

4. **Figure 2-10A.** Tighten (turn counterclockwise) the plastic locking nut on the neck of the CRT.
5. **Figure 2-10A.** Connect the following cable connectors to the CRT video board:
 - Ground cable to connector **PIN1**
 - 6-wire, 8-pin connector to connector **J203**
 - 5-wire, 7-pin connector to connector **J202**
 - Single-pin connector to connector **SC**
 - 8-wire video connector to connector **J201**
 - 6-wire cable connector to connector **J204**
6. **Figure 2-10A.** Replace the two flyback transformer cables (from connectors **J203** and **SC**) in the cable retainer located beneath the neck of the CRT.
7. **Figure 2-10B.** Replace the cable clamp in the notch at the back of the video board. Insert the video cable in the cable clamp, and install the mounting screw.
8. Replace the rear cover.
9. Make sure the monitor is adjusted correctly. Perform the "Monitor Inspection" procedure found in Section 4, Troubleshooting.

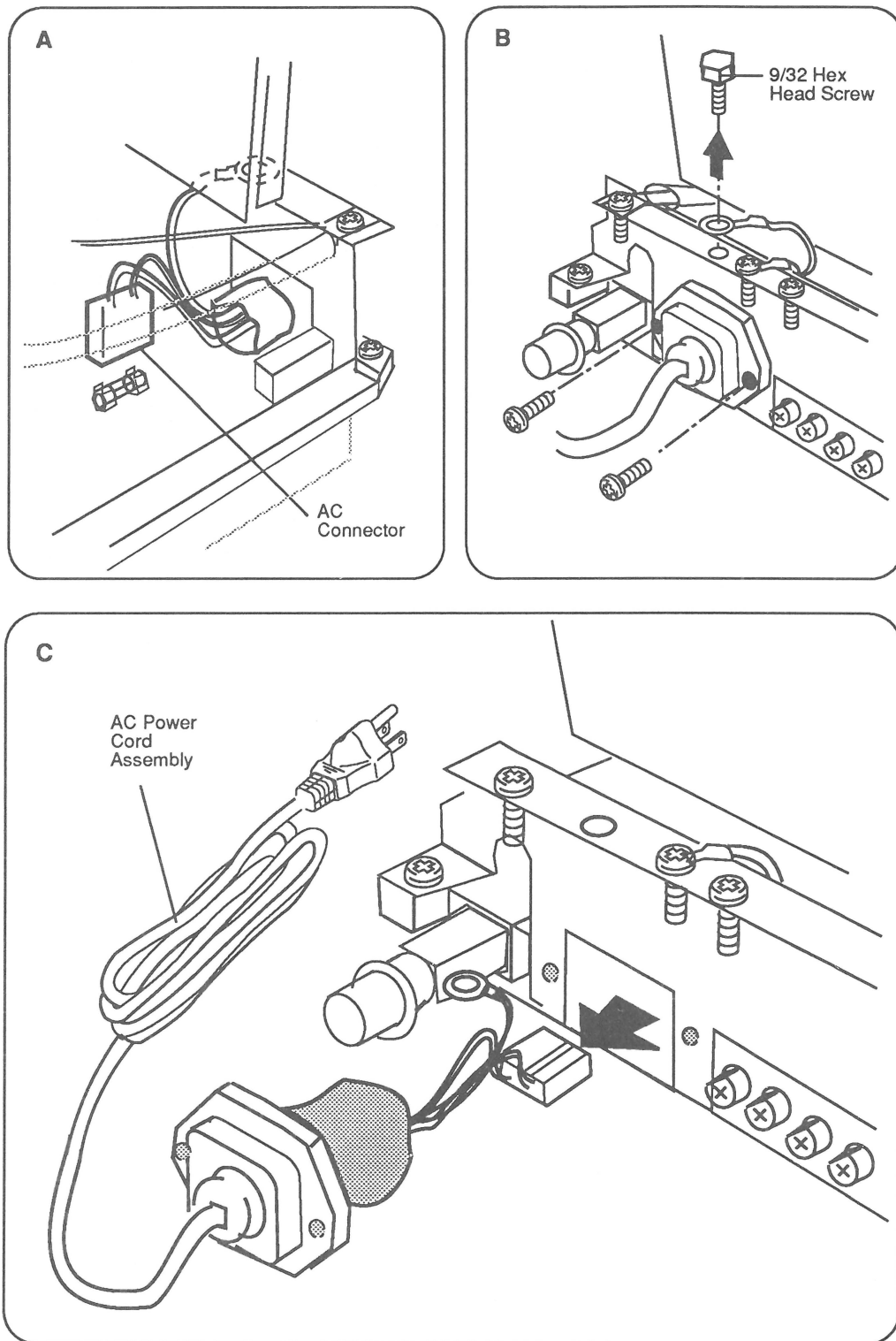


Figure 2-11 Removing the External Power Cable

□ EXTERNAL POWER CABLE (DOMESTIC ONLY)

Perform the following procedure only when you replace or remove the external power cable from the domestic version of the Macintosh 12-Inch RGB Display. The international version of the 12-Inch RGB Display has a detachable external power cable.

Materials Required

Medium Phillips screwdriver
9/32-inch hex nut driver, or small adjustable wrench

Remove

1. Remove the rear cover and discharge the CRT.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. **Figure 2-11A.** Disconnect the two-wire, three-pin power connector from the **AC** connector on the main deflection board.
4. **Figure 2-11B.** Using a 9/32-inch hex driver or a small adjustable wrench, remove the hex head screw that secures the AC ground cable to the rear metal chassis.
5. **Figure 2-11B and 2-11C.** Remove the two screws that secure the power cable to the metal chassis, and remove the power cable.

Replace

1. **Figure 2-11C and 2-11B.** Insert the three-wire power connector through the mounting hole in the metal chassis. Secure the power cable to the chassis with two screws.
2. **Figure 2-11B.** Secure the AC ground cable to the metal chassis with the hex head screw. Use the 9/32-inch hex driver or a small adjustable wrench to tighten the screw.
3. **Figure 2-11A.** Connect the two-wire, three-pin power connector to the **AC** connector on the main deflection board.
4. Replace the rear cover.

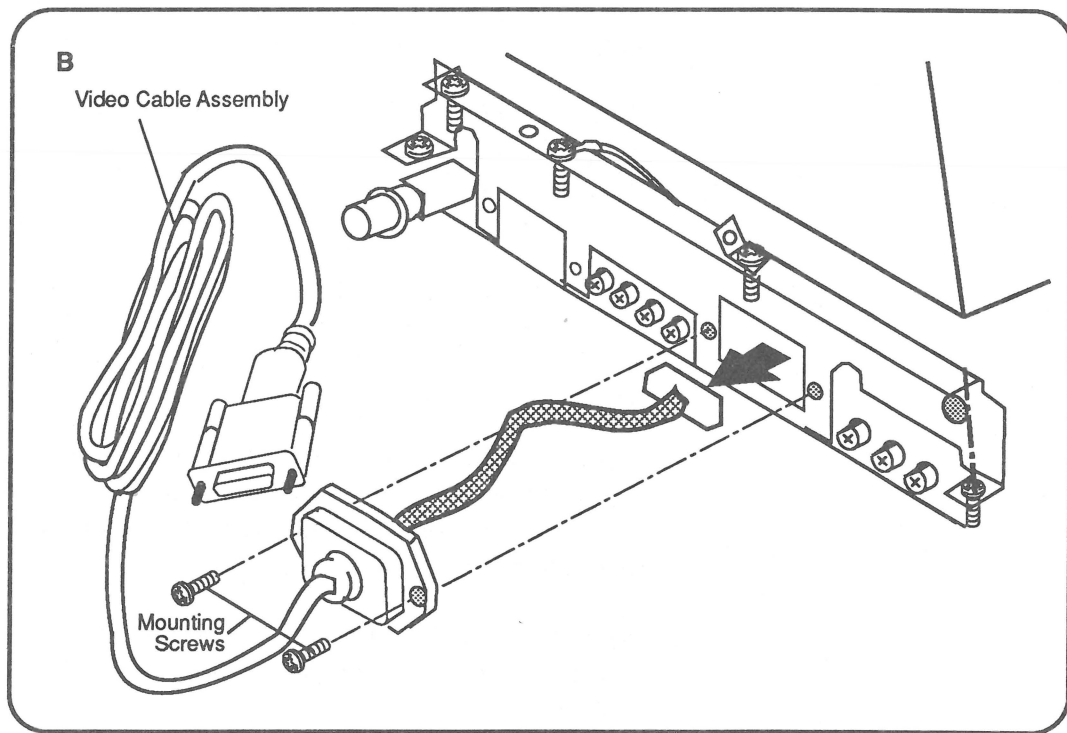
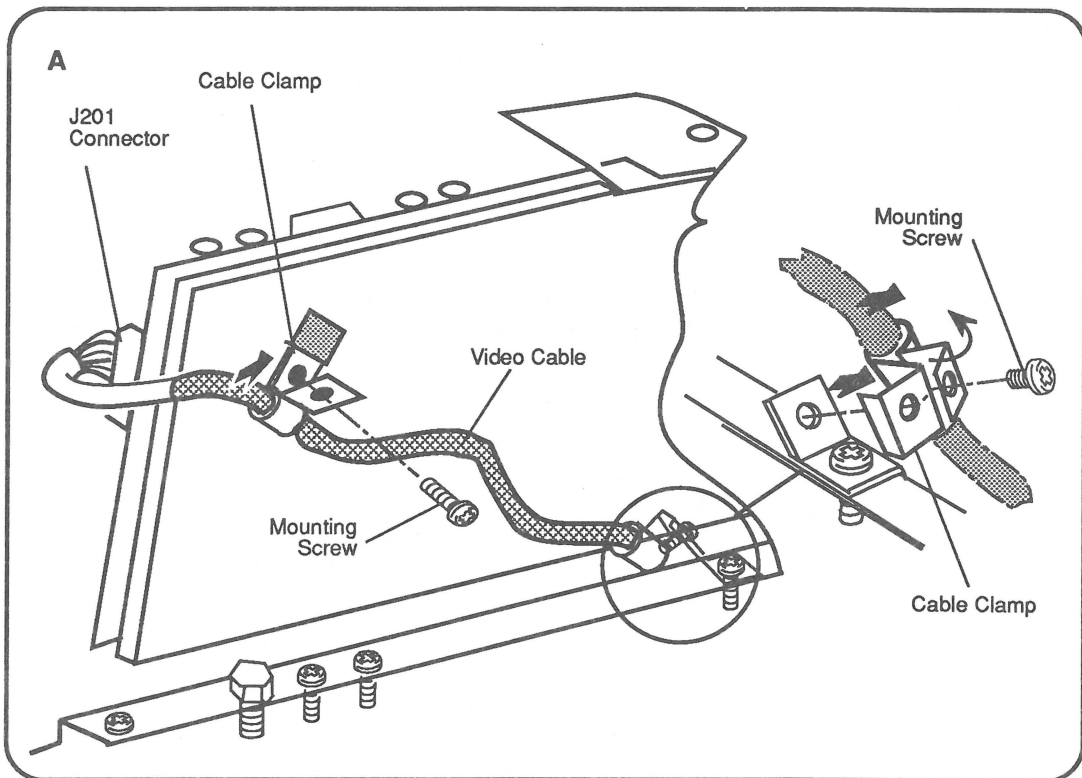


Figure 2-12 Removing the Video Cable

□ CPU-TO-MONITOR CABLE

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover and discharge the CRT.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. **Figure 2-12A.** Disconnect the eight-wire video connector from connector **J201** on the CRT video board.
4. **Figure 2-12A.** Remove the screw that secures the video cable to the back of the CRT video board. Remove the video cable from the cable clamp.
5. **Figure 2-12A.** Remove the screw that secures the video cable to the mounting bracket on the rear chassis. Remove the video cable from the cable clamp.
6. **Figure 2-12B.** Remove the two screws that secure the video cable to the metal chassis, and remove the video cable.

Replace

1. **Figure 2-12B.** Insert the eight-wire video connector through the mounting hole. Secure the video cable to the metal chassis with two screws.
2. **Figure 2-12A.** Replace the lower end of the video cable in the chassis cable clamp. Position the chassis cable clamp on the chassis mounting bracket as shown in **Figure 2-12A**, and install the mounting screw.
3. **Figure 2-12A.** Replace the upper end of the video cable in the video board cable clamp. Insert the video board cable clamp into the mounting hole in the back of the video board, and install the mounting screw.
4. **Figure 2-12A.** Connect the eight-wire video connector to connector **J201** on the CRT video board.
5. Replace the rear cover.

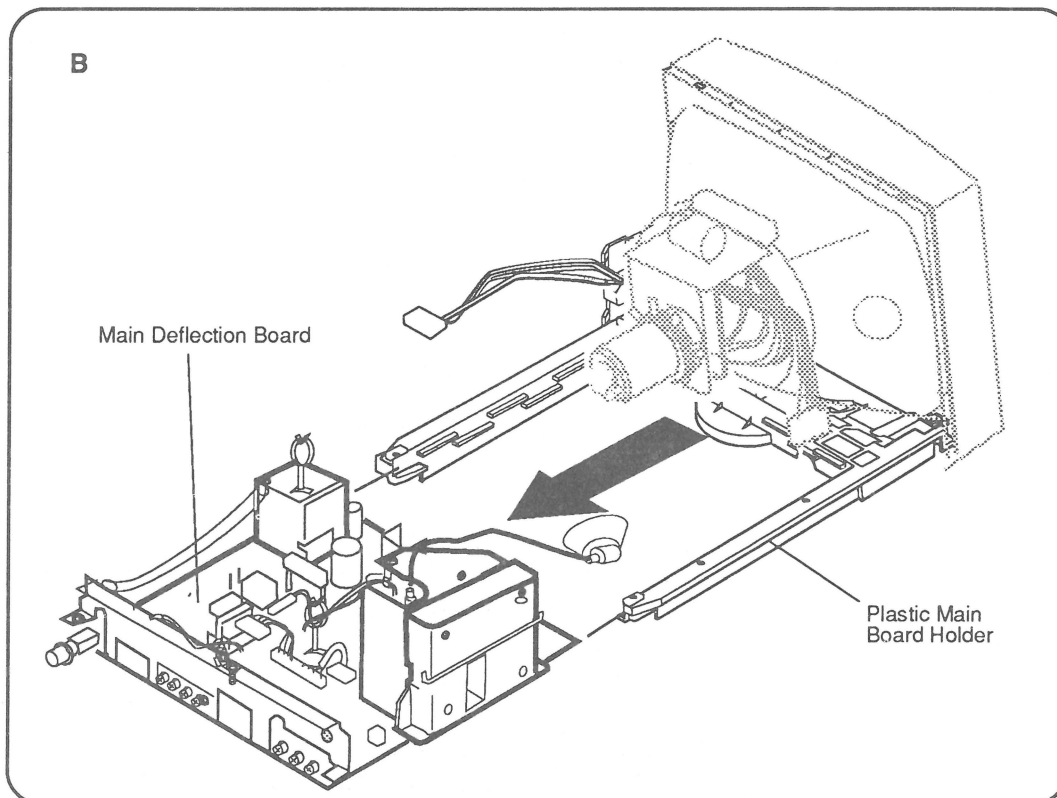
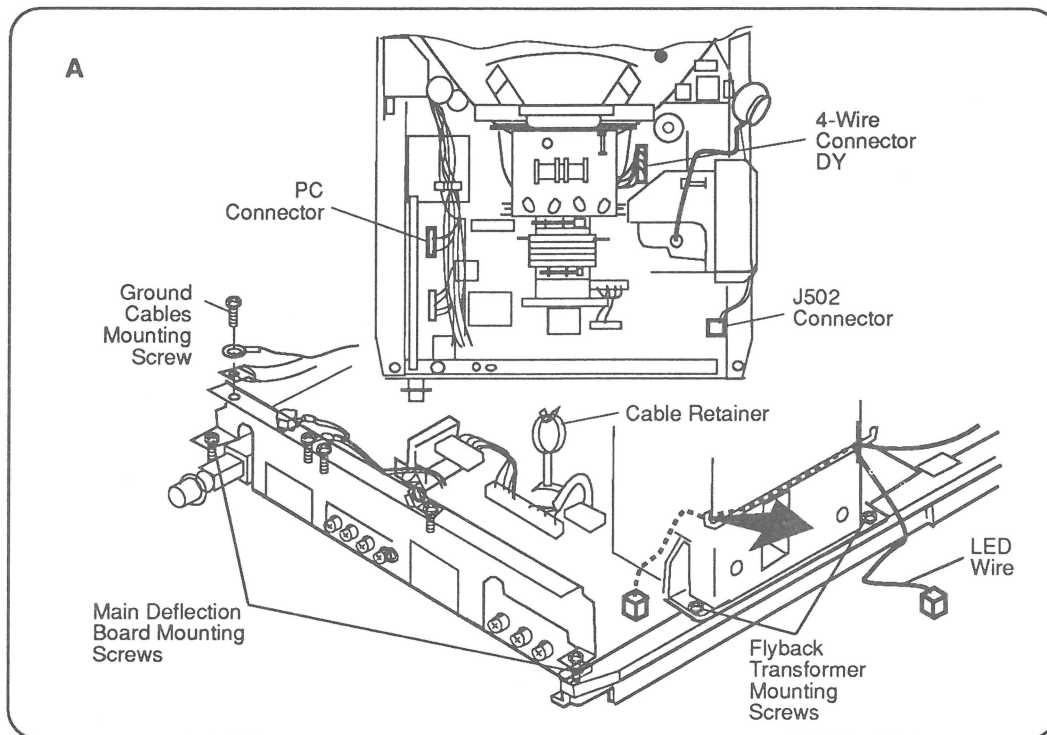


Figure 2-13 Removing the Main Deflection Board

□ MAIN DEFLECTION BOARD

Materials Required

Small and medium Phillips screwdrivers

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. Remove the CRT video board.
4. Remove the external power cable and the CPU-to-monitor cable.
5. **Figure 2-13A.** Disconnect the following cable connectors from the main deflection board:
 - 2-wire cable connector from connector **PC**
 - 2-wire LED connector from connector **J502** (Unlace the LED cable from the back of the flyback transformer.)
 - 4-wire yoke connector from connector **DY**
6. **Figure 2-13A.** Remove the screw that secures the two internal ground cables to the metal chassis.
7. **Figure 2-13A.** Remove all cables from the cable retainer on the main deflection board.
8. **Figure 2-13A.** Remove the two screws that secure the flyback transformer to the right stem of the plastic main board holder.
9. **Figure 2-13A.** Remove the two screws that secure the rear chassis to the end of both stems of the plastic main board holder.
10. **Figure 2-13B.** Pull the main deflection board straight out of the channels in the plastic main board holder.

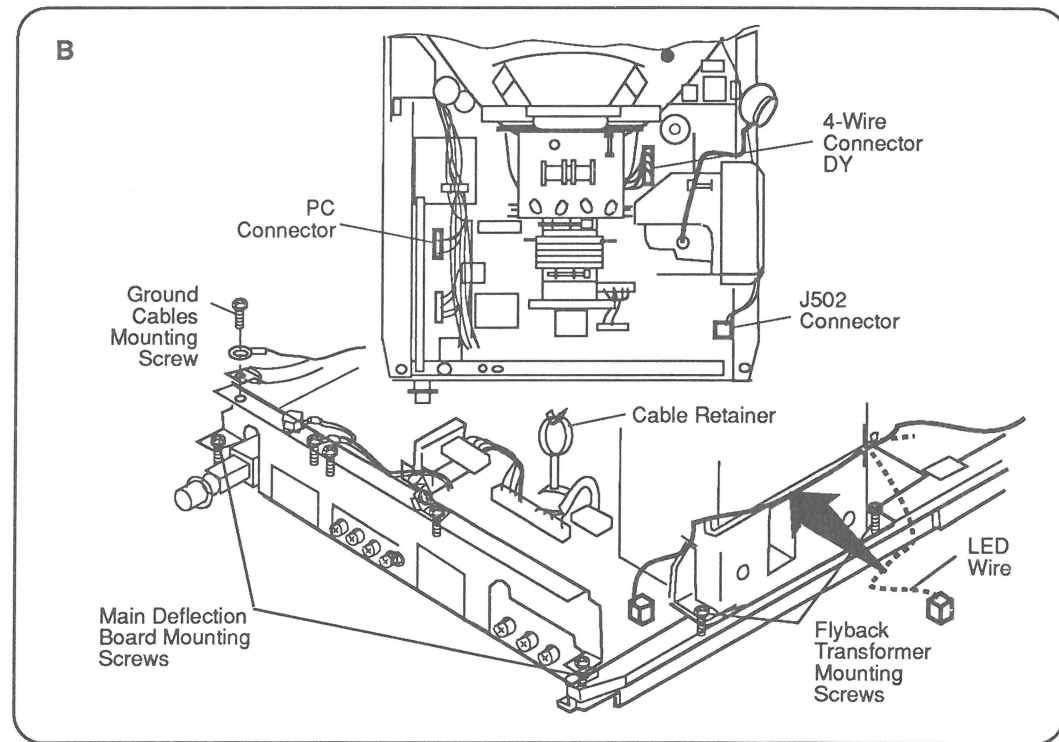
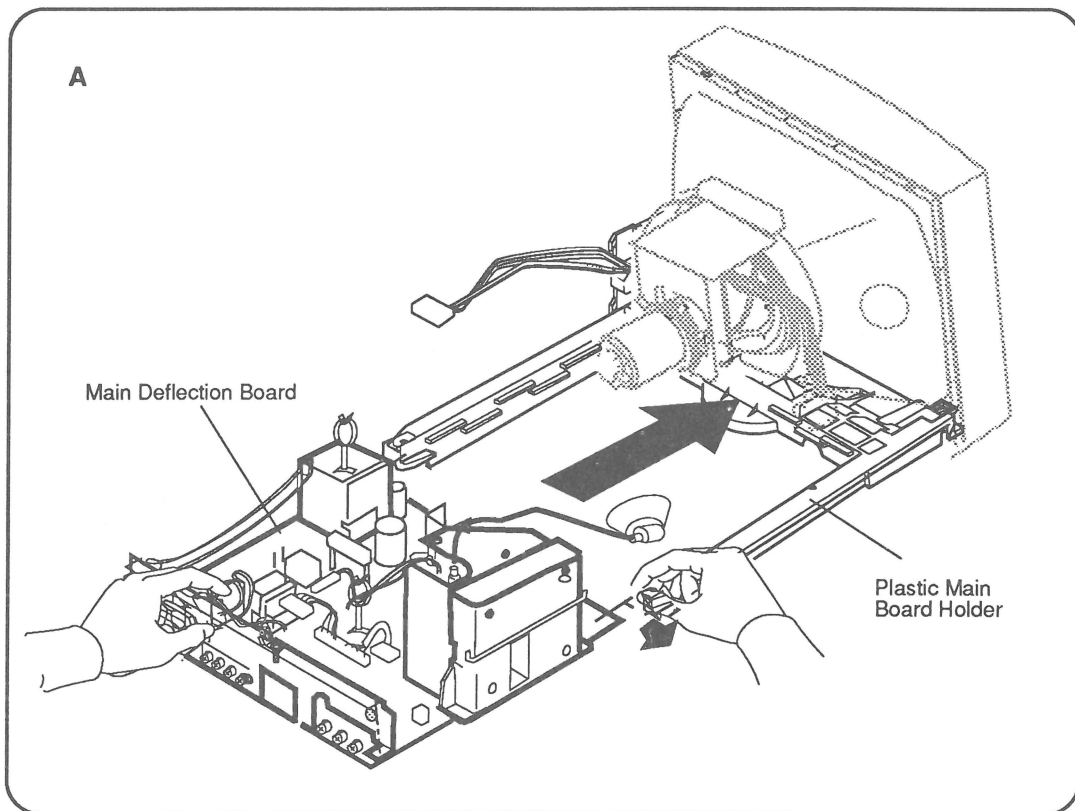


Figure 2-14 Installing the Main Deflection Board

Install

1. **Figure 2-14A.** Replace the main deflection board in the plastic main board holder. To do so:
 - a) Pull the right stem of the main board holder out of the way (the stem has enough play that it will not break), and slide the left edge of the deflection board into the channel tabs along the left stem.
 - b) Push in the deflection board until it is secure in the channel tabs at the front edge of the main board holder.
 - c) Install the right stem of the main board holder onto the right edge of the board.
2. **Figure 2-14B.** Replace the two mounting screws that secure the rear chassis to the plastic main board holder.
3. **Figure 2-14B.** Replace the two mounting screws that secure the flyback transformer to the right stem of the plastic main board holder.
4. **Figure 2-14B.** Position the two internal ground cables on the metal chassis and replace the mounting screw.
5. **Figure 2-14B.** Connect the following cable connectors to the main deflection board:
 - 4-wire yoke connector to connector **DY**
 - 2-wire LED connector to connector **J502**
(Be sure to lace the LED cable through the back of the flyback transformer.)
 - 2-wire cable connector to connector **PC**
6. **Figure 2-14B.** Replace all cables in the cable retainer on the main deflection board.
7. Replace the external power cable and the CPU-to-monitor cable.
8. Replace the CRT video board.
9. Replace the anode cap and rear cover.
10. Make sure the monitor is adjusted correctly. Perform the "Monitor Inspection" procedure found in Section 4, Troubleshooting.

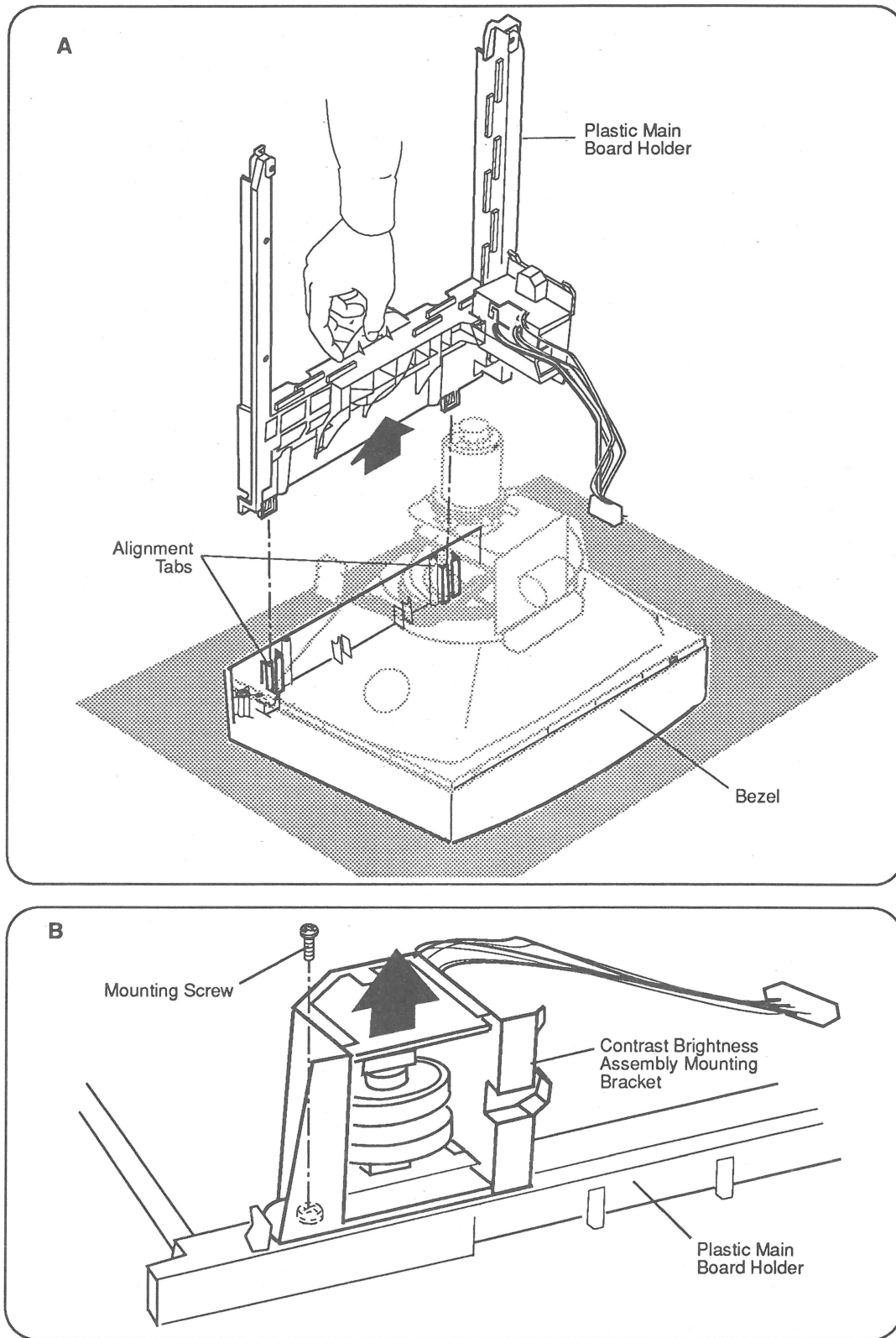


Figure 2-15 Removing the Plastic Main Board Holder

□ PLASTIC MAIN BOARD HOLDER

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. Remove the CRT video board and the main deflection board.
4. Place the monitor face-down on the protective mat.
5. **Figure 2-15A.** Disengage and remove the plastic main board holder from the bezel. Lift and pull at the left and right front edge of the main board holder.
6. **Figure 2-15B.** Remove the mounting screw that secures the contrast/brightness assembly mounting bracket to the main board holder. Remove the mounting bracket from the main board holder.

Replace

1. **Figure 2-15B.** Replace the contrast/brightness assembly mounting bracket on the plastic main board holder, and install the mounting screw.
2. **Figure 2-15A.** Align the two plastic tabs at the front edge of the main board holder with the two channels in the bezel. Push the main board holder into the bezel until the tabs engage.
3. Place the monitor and plastic main board holder upright on the protective mat.
4. Replace the main deflection board and the CRT video board.
5. Replace the anode cap and rear cover.

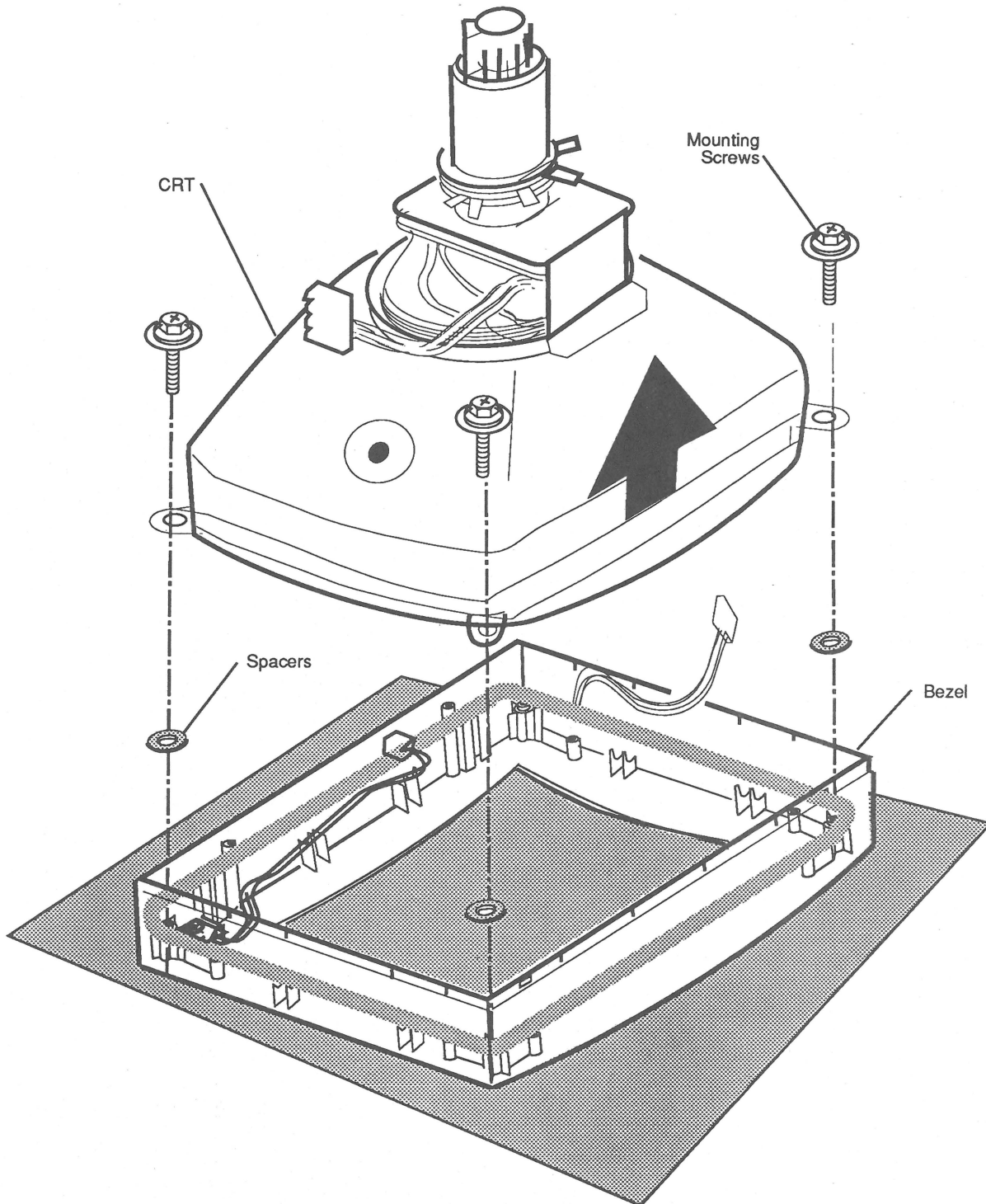


Figure 2-16 Replacing the CRT Assembly

□ CRT ASSEMBLY

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. Remove the CRT video board, the main deflection board, and the plastic main board holder.
4. **Figure 2-16.** Remove the four screws with attached lockwashers from the corners of the CRT.

WARNING: *Never grasp the neck of the CRT in order to remove the CRT assembly from the bezel. This high-vacuum cathode-ray tube contains high voltages and can be easily cracked or broken.*

5. **Figure 2-16.** Carefully lift the CRT out of the bezel and place it face-down on the protective pad.
6. **Figure 2-16.** Remove the four spacers from the plastic standoffs at the corners of the bezel.

Replace

1. **Figure 2-16.** Replace the four spacers, rubber side up, on the plastic standoffs in the bezel corners.
2. **Figure 2-16.** Carefully replace the CRT inside the bezel. Make sure the anode aperture in the CRT is at the side of the bezel nearest the LED.
3. **Figure 2-16.** Replace the four screws with attached lockwashers that secure the CRT to the bezel.
4. Replace the plastic main board holder, the main deflection board, the CRT video board, the anode cap, and the rear cover.
5. Make sure the monitor is adjusted correctly. Perform the "Monitor Inspection" procedure found in Section 4, Troubleshooting.

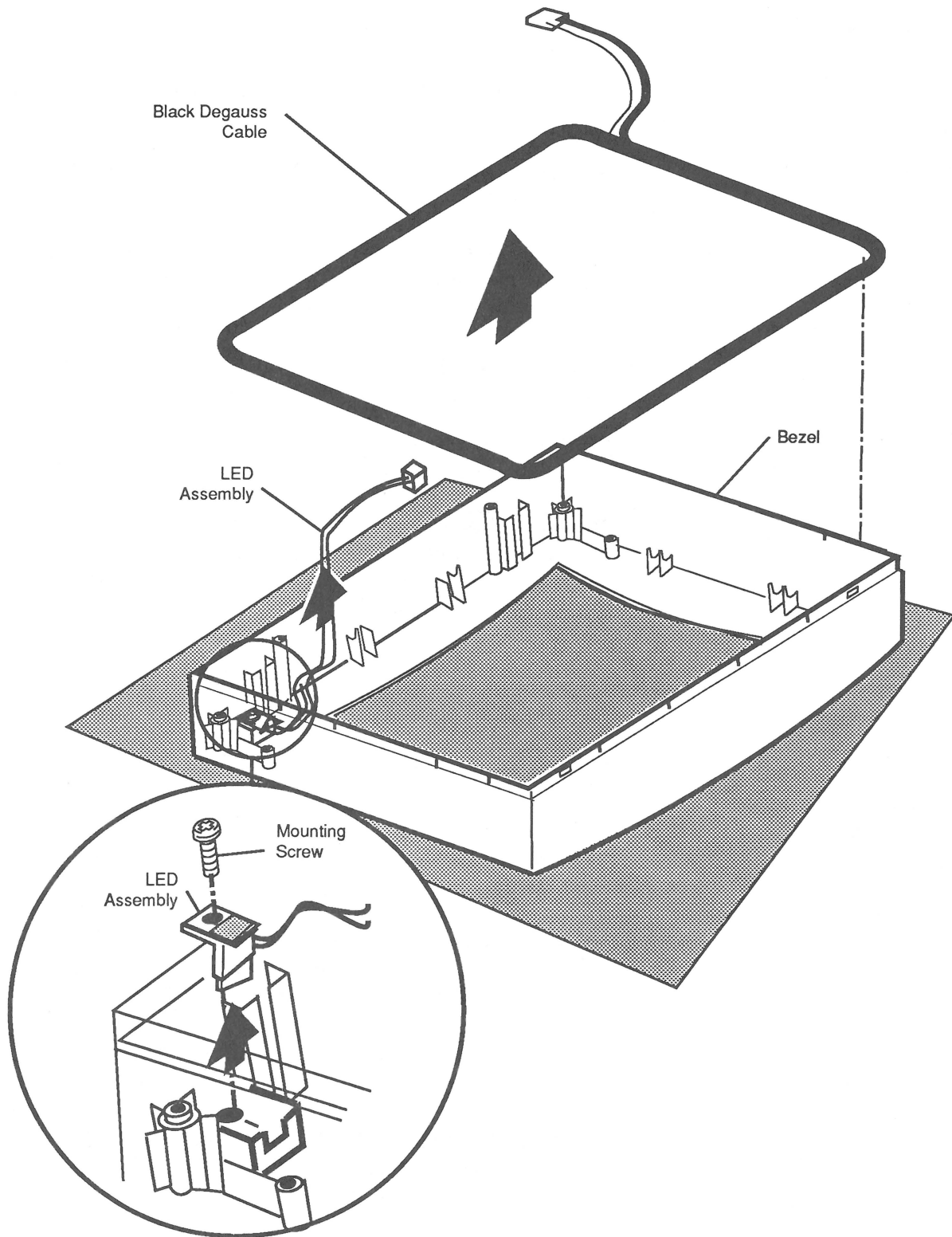


Figure 2-17 Replacing the LED Assembly

□ LED ASSEMBLY WITH CABLE

Materials Required

Small Phillips screwdriver

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. Remove the CRT video board, the main deflection board, and the plastic main board holder.
4. Remove the CRT assembly.
5. **Figure 2-17.** Remove the black DeGauss cable from the bezel. Connector **PC** is attached to the cable.
6. **Figure 2-17.** Remove the screw that secures the LED assembly to the bezel, and remove the LED assembly.

Replace

1. **Figure 2-17.** Insert the LED assembly in the bezel mounting bracket, and replace the LED mounting screw.
2. **Figure 2-17.** Replace the black DeGauss cable along the inside edge of the bezel. Make sure connector **PC** is positioned as shown in **Figure 2-17**, and the cable is pressed down into the notched standoffs.
3. Replace the CRT assembly.
4. Replace the plastic main board holder, the main deflection board, and the CRT video board.
5. Replace the anode cap and rear cover.

□ BEZEL

Remove

1. Remove the rear cover, discharge the CRT, and remove the anode cap.
2. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the grounding wriststrap until after discharging the CRT.)
3. Remove the CRT video board, the main deflection board, and the plastic main board holder.
4. Remove the CRT assembly and the LED assembly.
5. Replace the customer's damaged bezel.

Replace

1. Replace the LED assembly and the CRT assembly in the new bezel.
2. Replace the plastic main board holder, the main deflection board, and the CRT video board.
3. Replace the anode cap and rear cover.

Macintosh 12-Inch RGB Display

Section 3 – Adjustments

□ CONTENTS

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3.3	Safety Instructions
3.5	Live Adjustment Rules
3.5	Location of Controls
3.5	User Controls
3.5	External Service Controls
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3.21	Focus
3.23	White Balance
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□ INTRODUCTION

Whenever you replace a module within the Macintosh 12-Inch RGB Display, you may need to adjust the display.

Always check the geometric characteristics of the display (horizontal and vertical size, positioning, linearity, and focus) before returning a repaired monitor to the owner. For more information, refer to "Geometric Alignment Chart" in Section 4, Troubleshooting.

If you have replaced the main deflection board, the screen adjustment must be performed prior to performing any other necessary adjustments. As a general rule, if the main deflection board, the CRT assembly, or the CRT video board has been replaced, you should also perform the video/color adjustments. **However, the video/color adjustments should be performed only if the color quality is unacceptable.** (Special equipment is required to attain perfect color adjustments.)

WARNING: Do not attempt tilt or ring adjustments on the Macintosh 12-Inch RGB Display. All such yoke adjustments have been set by the manufacturer.

Use the procedures that follow to perform the adjustments listed below. Make sure that all geometric adjustments are correct before performing any required video adjustments.

Screen Adjustment

Geometric Adjustments:

- Vertical and Horizontal Center
- Vertical and Horizontal Size
- Vertical Linearity
- Vertical and Horizontal Hold
- Focus

Video/color Adjustments:

- White Balance

□ SAFETY INSTRUCTIONS

WARNING: *There are high voltages and a high-vacuum picture tube inside the Macintosh 12-Inch RGB Display. To prevent serious injury, learn all safety precautions in Section 1, Basics, before you proceed!*

In addition to following all safety precautions in the Basics section, be sure to:

- Keep one hand behind your back at all times, and grasp the handle of the insulated alignment tool with your other hand.
- Use a mirror for viewing adjustment results. **Never** attempt to make live adjustments while facing the screen and reaching around to the back of the monitor to rotate the controls—you cannot see what you are about to touch!
- Perform only those adjustments that are absolutely necessary. Do not attempt to make any adjustments other than the ones explained in this section, and do those with extreme caution.
- When performing the Screen Adjustment, keep in mind that the high-voltage probe reduces voltages at a ratio of 1000 to 1. A .5 V reading on the voltmeter is actually measuring 500 volts of direct current. Be sure to follow the high-voltage probe and voltmeter setup procedures, and make sure the high-voltage probe is grounded to the monitor chassis.

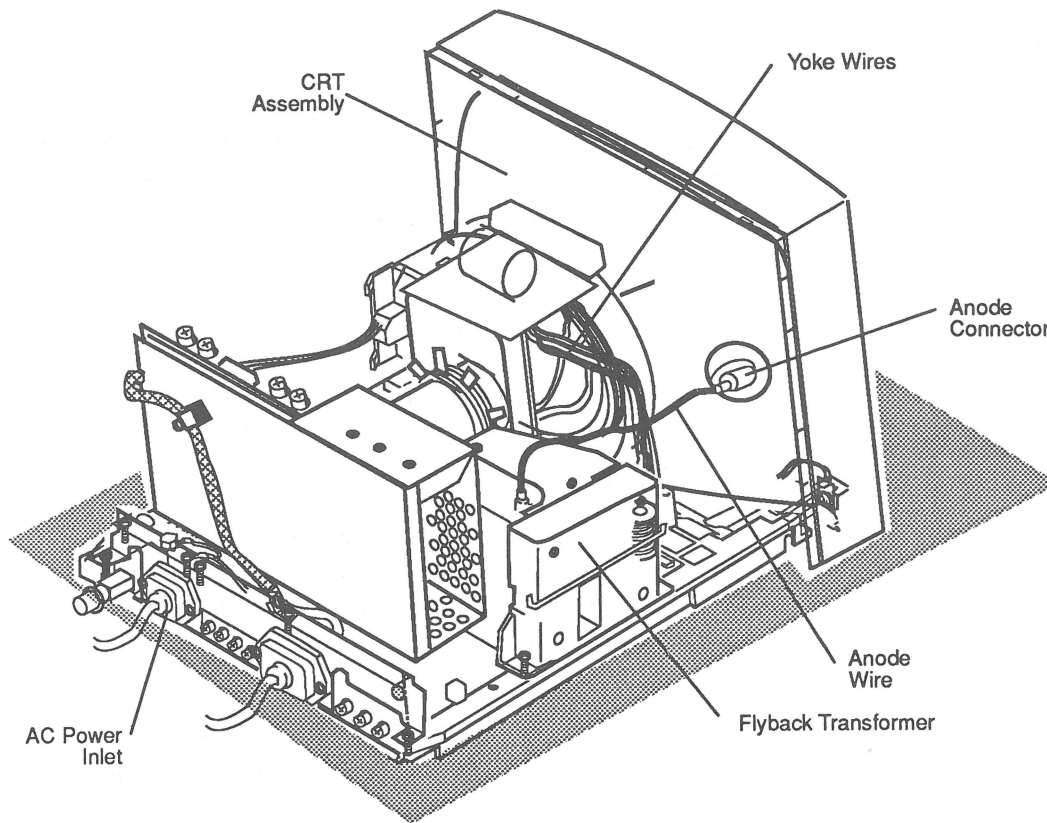


Figure 3-1 High-Voltage Areas and Components

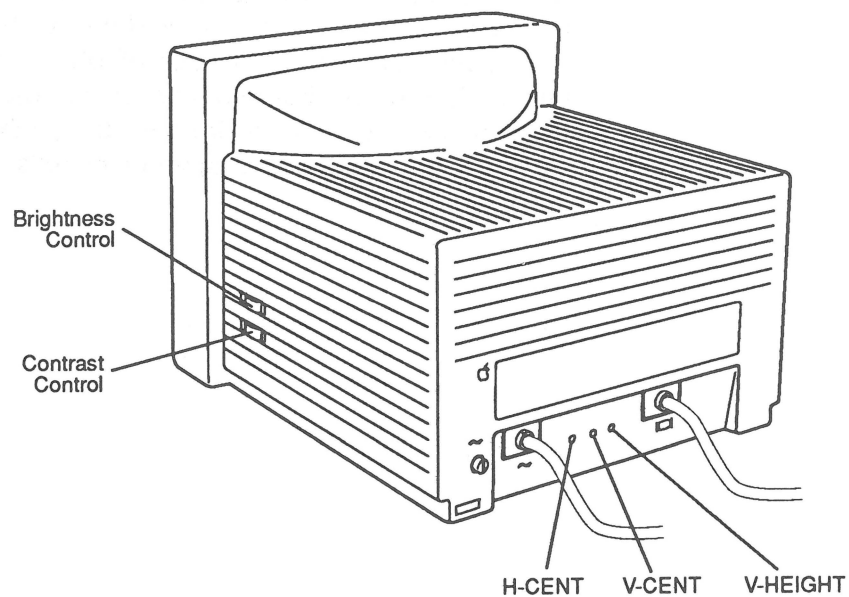


Figure 3-2 User and External Service Controls

WARNING: *Serious injury could result if, with the power on, you touch any of the high-voltage components shown in Figure 3-1.*

**Live
Adjustment
Rules**

In addition to the precautions listed on the previous page, never touch the following components when adjusting a live Macintosh 12-Inch RGB Display:

- Back of CRT assembly
- CRT yoke assembly, including the yoke wires
- Anode connector
- Anode wire
- Flyback transformer
- Inside the AC power inlet

□ LOCATION OF CONTROLS

**User
Controls**

Figure 3-2. The Brightness control and the Contrast control are located on the side of the monitor's case and are accessible to the user.

**External
Service
Controls**

Figure 3-2. The following service adjustment controls are located at the rear of the main deflection board. These controls can be accessed through the rear cover.

- H-CENT (VR503)
- V-CENT (VR403)
- V-HEIGHT (VR404)

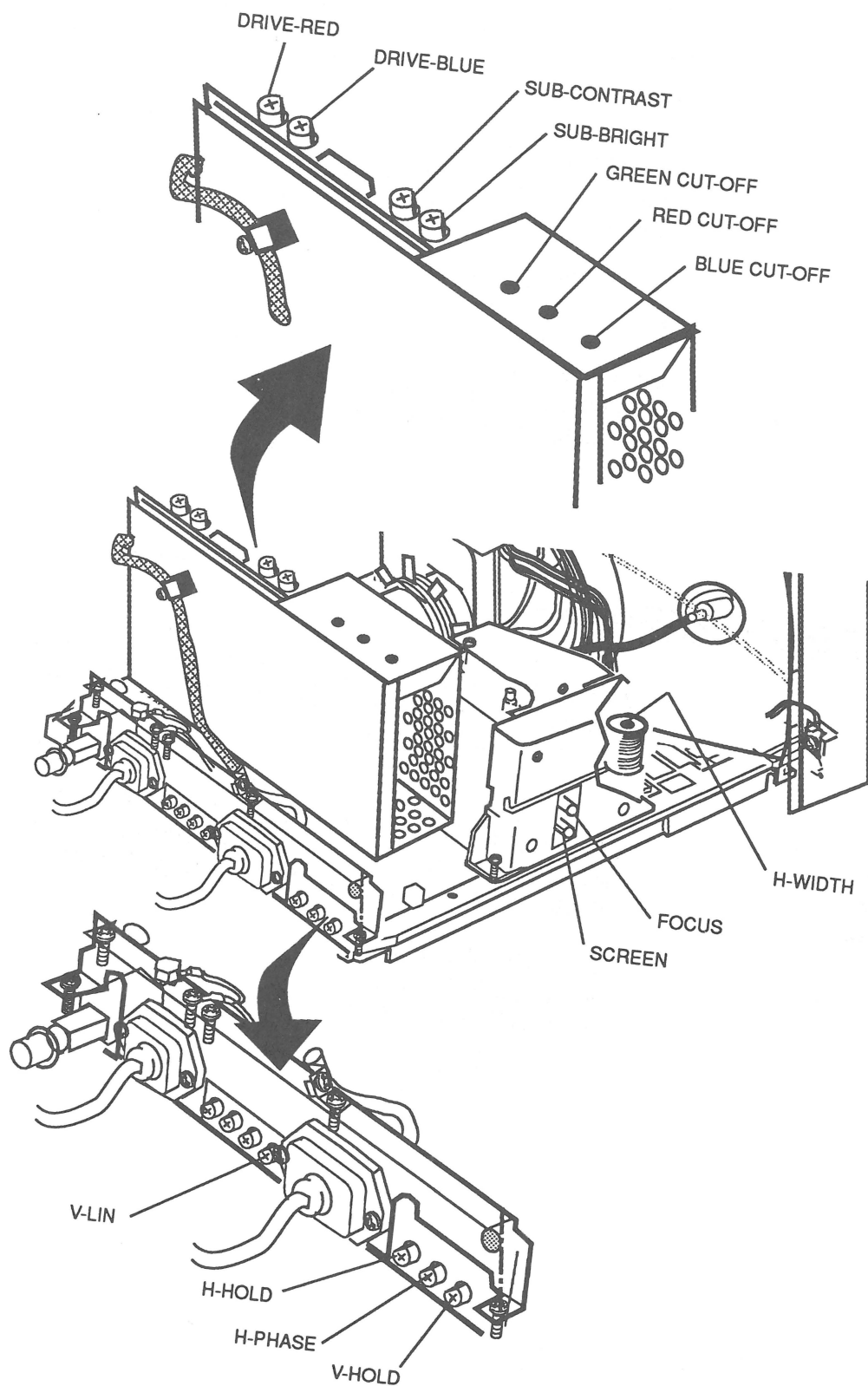


Figure 3-3 Internal Service Adjustment Controls

Internal Service Controls

Figure 3-3. The internal adjustment controls are located on the main deflection board, the CRT video board, and the flyback transformer. These controls can be accessed only after removing the rear cover.

Main deflection board controls:

- V-LIN (VR402)
- H-HOLD (VR502)
- H-PHASE (VR501)
- V-HOLD (VR401)
- H-WIDTH (L501)

CRT video board controls:

- DRIVE-RED (VR2R1)
- DRIVE-BLUE (VR2B1)
- SUB-CONTRAST (VR201)
- SUB-BRIGHT (VR202)
- CUT-OFF GREEN (VR6G1)
- CUT-OFF RED (VR6R1)
- CUT-OFF BLUE (VR6B1)

Flyback transformer controls:

- FOCUS
- SCREEN

□ MACTEST TEST PATTERNS

The *MacTest MP* diagnostic program for the Macintosh IIsx and Macintosh LC computers displays test patterns for adjusting the Macintosh 12-Inch RGB Display. *MacTest MP* does not diagnose monitor problems; to diagnose monitor problems, refer to Section 4, Troubleshooting.

Materials Required

Macintosh IIsx or Macintosh LC
MacTest MP diagnostic disk

Generating the Test Patterns

Follow the steps below to test the video RAM or display the monitor test patterns.

1. Connect the monitor's video cable to the Macintosh test station. Connect the monitor's power cable to an AC power outlet.
2. Switch on power to the computer and to the monitor, and insert the *MacTest MP* disk.
3. Open the *MacTest MP* disk icon, and open the *MacTest MP* application icon.

Note: Apple recommends testing the video RAM installed on the VRAM SIMM before performing the video adjustments.

4. From the main window shown in **Figure 3-4**, deselect any default tests that you do not want to run at this time. Clicking in a box marked with an "x" deselects that test.
5. **Figure 3-4.** To test the video RAM, make sure **Video RAM Test** is selected. If the **Video RAM Test** selection box is blank, click on the box to select it.
6. **Figure 3-4.** To display the monitor adjustment test patterns, first click on the monitor icon in the lower right corner of the main window. The monitor icon is highlighted to indicate its selection.
7. **Figure 3-4.** Now click the Start icon at the top of the main window to proceed. You will encounter one or both of these scenarios:

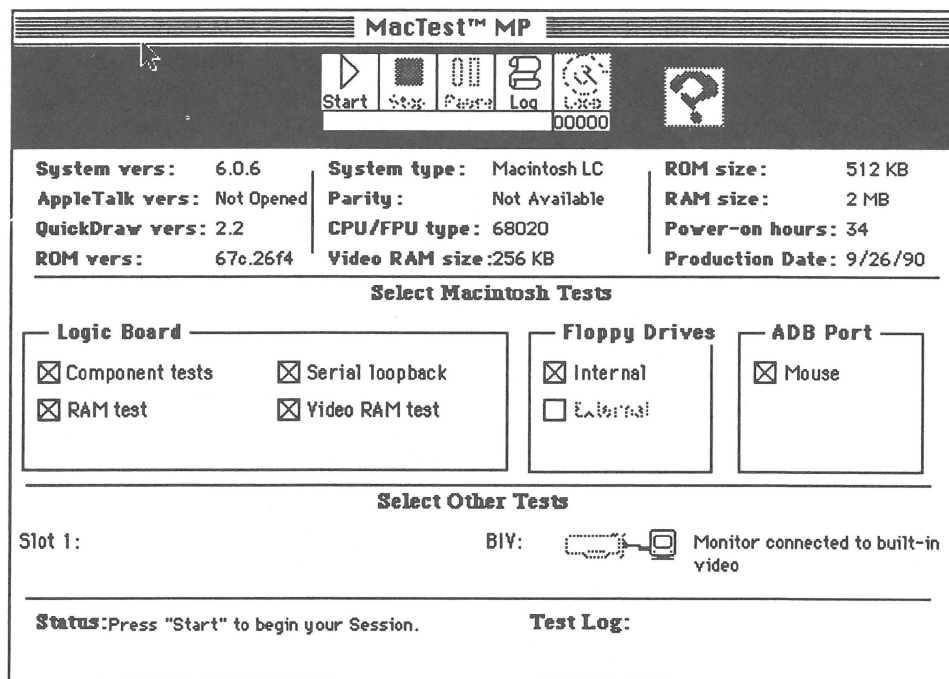


Figure 3-4 MacTest MP Main Window

- If you chose to test the video RAM, the screen turns blank. After a few seconds the Status line in the bottom-left corner of the main window indicates whether the VRAM test passed. If the VRAM is OK, the test automatically cycles to the first monitor test pattern.
- If you chose to display only the monitor test patterns, the first (gray bars) test pattern is displayed on the screen. *MacTest MP* displays the test patterns listed below:
 - Gray Bars
 - Full Black Screen
 - Full White Screen
 - Crosshatch I (black background)
 - Crosshatch II (white background)
 - Focus

Click the mouse or depress the Space bar to advance through the test patterns (each test pattern is shown once). To display a previous pattern, press the dash/hyphen key. After you have cycled through the test patterns, you are returned to the main window.

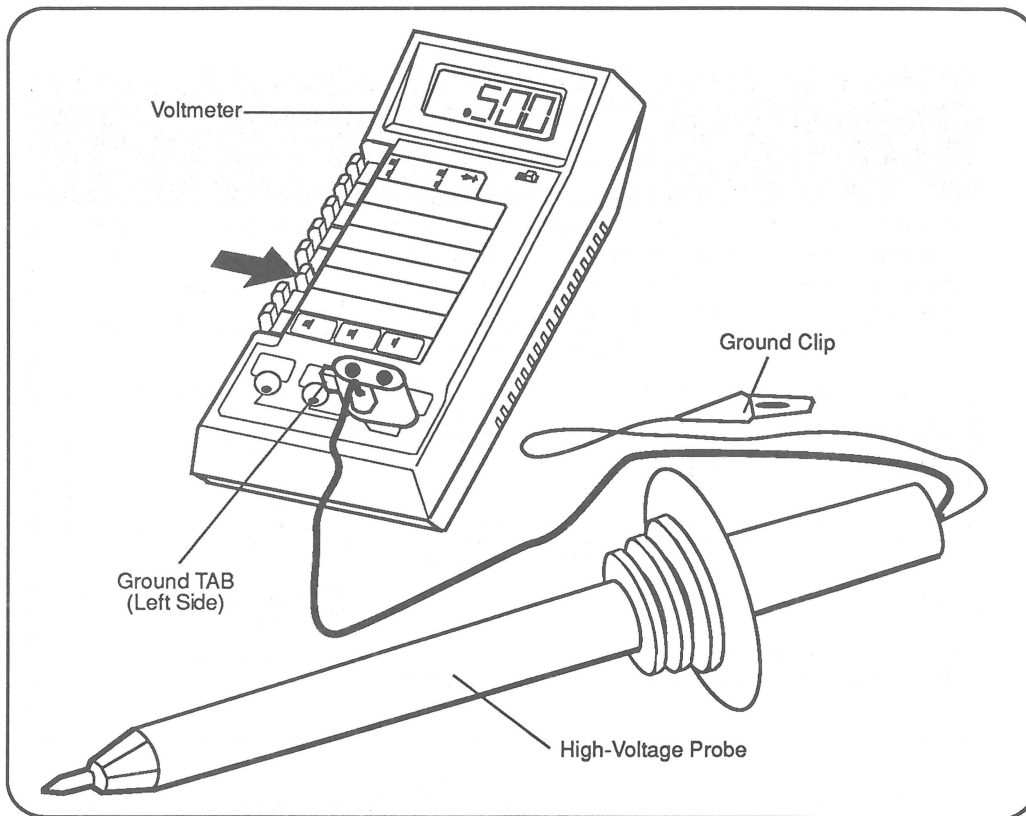


Figure 3-5 Setting Up the Voltmeter and High-Voltage Probe

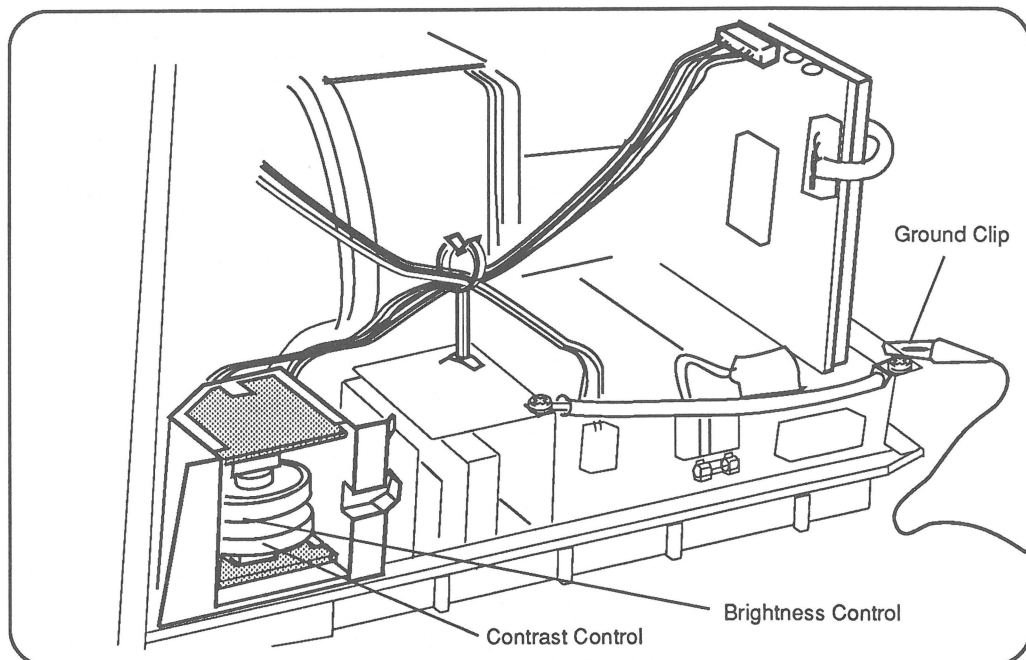


Figure 3-6 Setting the User Controls

□ ADJUSTMENT PROCEDURES

Materials Required

High-voltage probe
Voltmeter
Plastic adjustment tool or insulated screwdriver
Hex-head, plastic adjustment tool at least 6 inches long
Mirror
Flexible ruler (preferably metric)
Light meter (Sekonic Multi-Lumi, model L-248)

Screen Adjustment

The screen adjustment procedure should be performed **only** if one or more of the following conditions is true:

- You have replaced the main deflection board
- You have inadvertently altered the screen adjustment
- You have replaced the CRT/yoke assembly with a CRT/yoke assembly from a different vendor (see **Figure 3-8** and accompanying text)

Perform the screen adjustment procedure first, before performing any other necessary adjustments.

Setting Up the Voltmeter and High-Voltage Probe

1. **Figure 3-5.** Switch on voltmeter power, and set the voltmeter to the 2 VDC (or lowest) setting.
2. **Figure 3-5.** Connect the two-pronged connector of the high-voltage probe to the common ground (COM) and voltage (V, Ω) receptacles on the voltmeter. Make sure
 - The prong on the side of the connector marked with the plastic ground (GND) tab is inserted in the common ground (COM) receptacle
 - The **other** prong on the connector is inserted in the voltage (V, Ω) receptacle

Adjustment Procedure

1. Switch off monitor power and remove the rear cover (see Section 2, Take-Apart). Switch on monitor power and let the monitor warm up for at least 10 minutes.
2. **Figure 3-6.** Attach the small ground clip from the high-voltage probe to the metal monitor chassis.
3. **Figure 3-6.** Set the Brightness control to detent (midrange), and set the Contrast control to maximum contrast (turn the knob away from the screen).

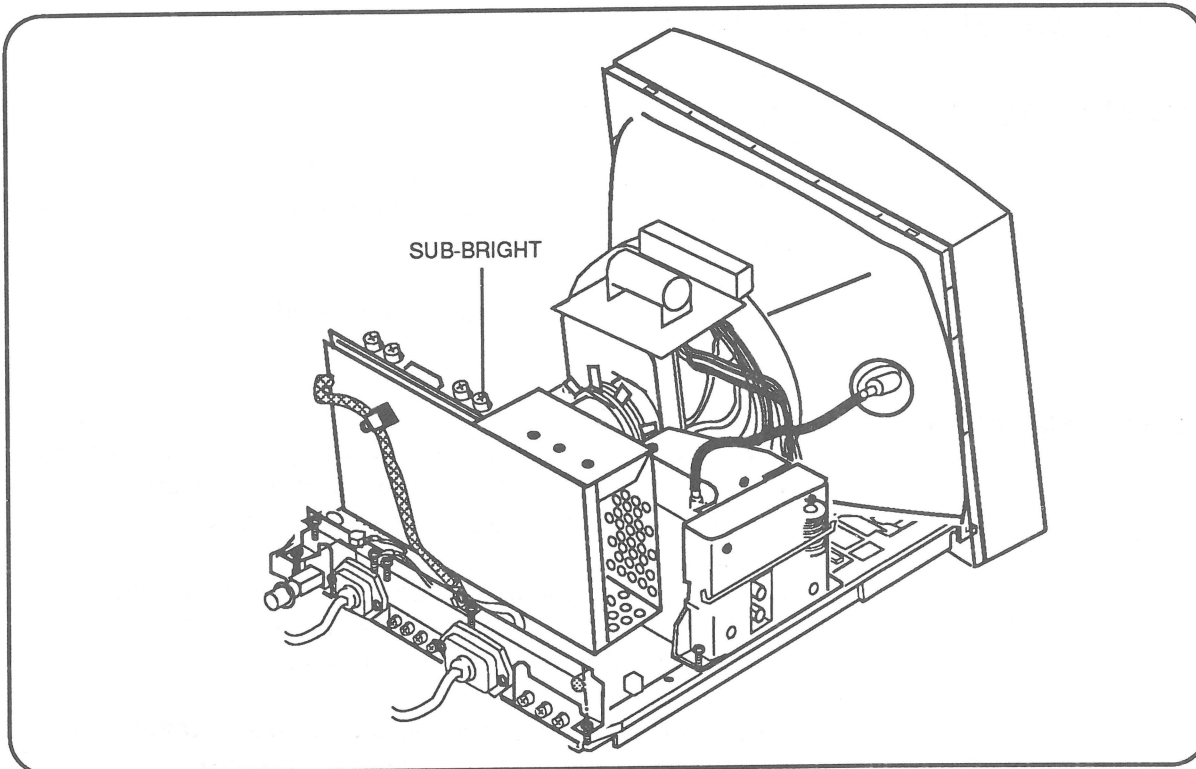


Figure 3-7 SUB-BRIGHT Control

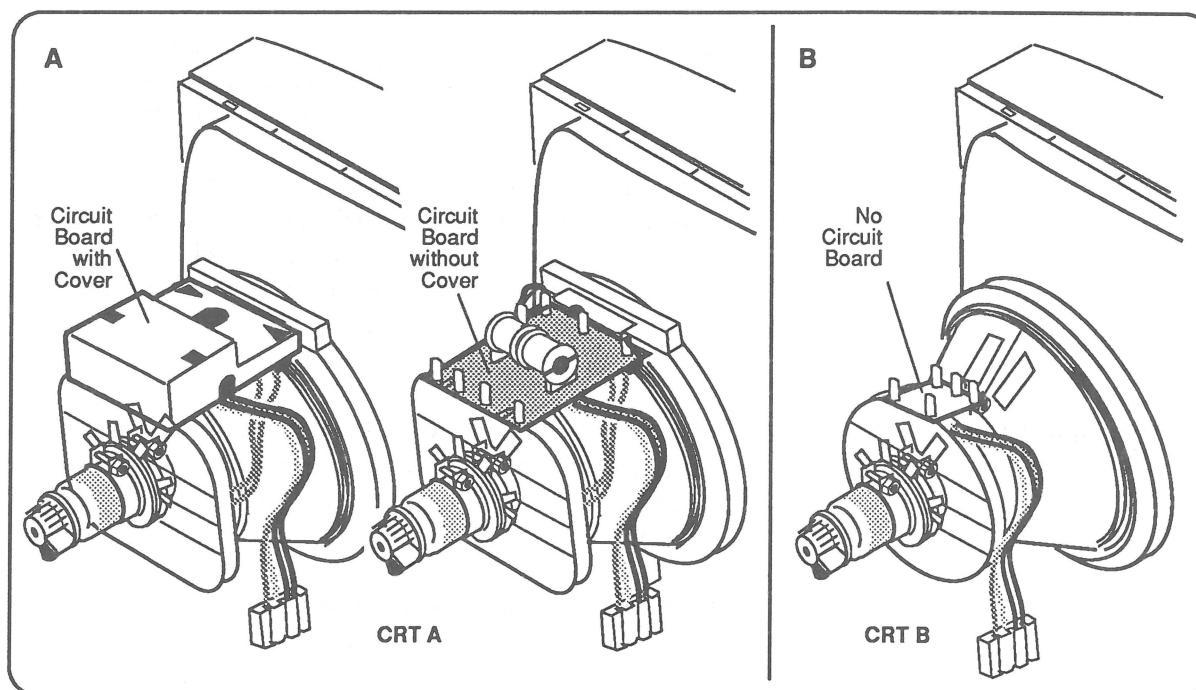


Figure 3-8 Determining CRT/Yoke Assembly Version

4. Display the Full Black Screen test pattern on the monitor (see "MacTest Test Patterns").
5. **Figure 3-7.** Turn the SUB-BRIGHT control (VR202) all the way down (counterclockwise).

WARNING: Before performing the next step, make sure the ground clip from the high-voltage probe is attached to the metal monitor chassis. The next step requires that you measure voltages in excess of 500 volts DC. Be sure to use the high-voltage probe correctly (see "Setting Up the Voltmeter and High-Voltage Probe"). Also, be careful not to cause a short between test point (SCREEN or PIN 4) and adjacent components when using the test probe (see **Figure 3-8**).

6. **Figure 3-8.** There are two vendors for the CRT/yoke assembly. For each vendor's product the screen voltage must be set to a different reading. Determine which vendor's CRT you have (let's call them **CRT A** and **CRT B**). **CRT A** has a 2 1/2" x 2 1/2" circuit board (with or without a plastic cover) that covers nearly all of the top area of the yoke (see **Figure 3-8A**). **CRT B** has a 1" x 1 1/4" plastic rectangle **without circuitry** (see **Figure 3-8B**).

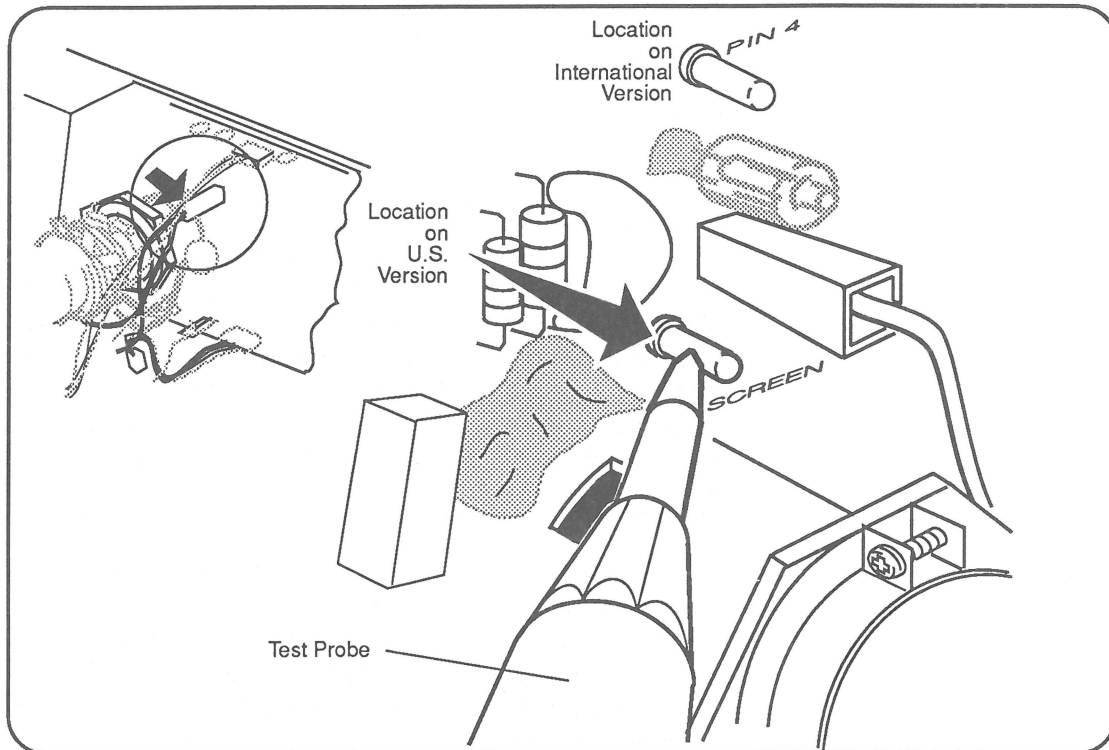


Figure 3-9 Measuring Voltage at the SCREEN or PIN 4 Test Point

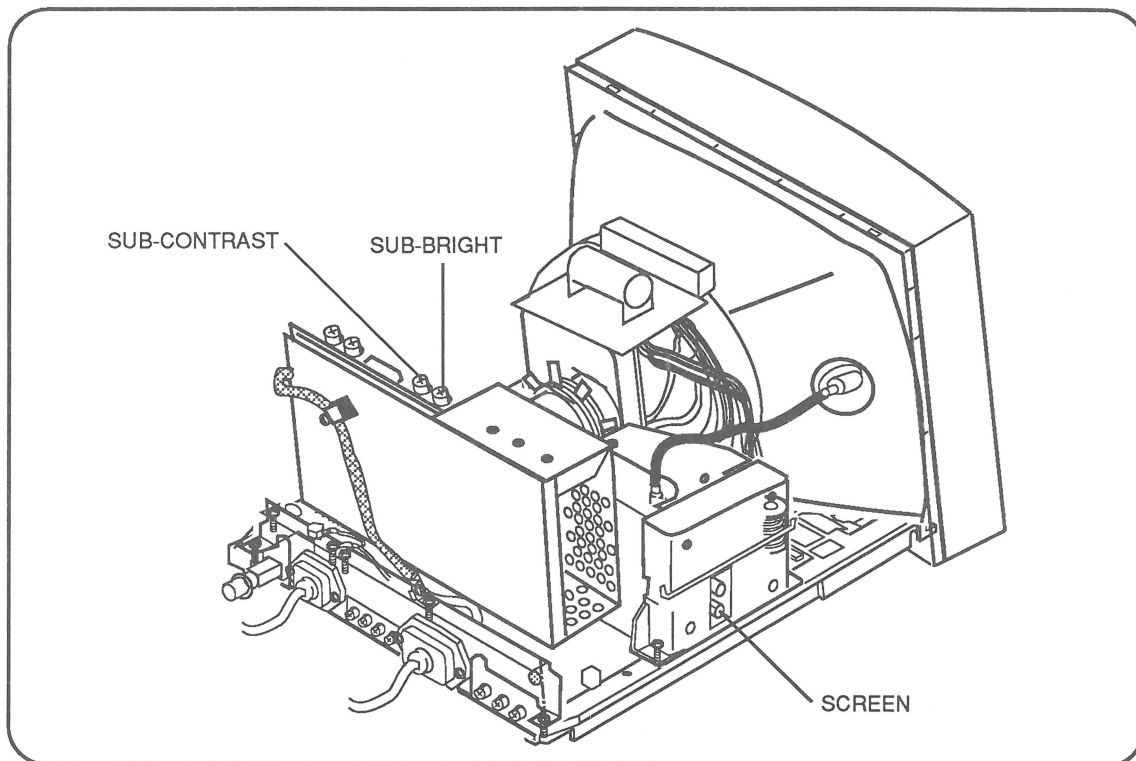


Figure 3-10 SUB-BRIGHT and SCREEN Controls

7. **Figure 3-9.** Once you have determined which CRT/yoke assembly you have, touch the high-voltage probe to the voltage test point on the CRT video board labeled SCREEN (U.S. version) or PIN 4 (international version), and read the output at the voltmeter. The reading should be:
 - .500 V (\pm .005 V) for **CRT A**
 - .400 V (\pm .004 V) for **CRT B**If the reading is off, adjust the SCREEN control on the flyback transformer (see **Figure 3-10**).
8. Remove and disconnect the high-voltage probe from the monitor.
9. **Figure 3-10.** Because the monitor has been displaying the Full Black Screen pattern and you need a visible pattern for the remainder of this step, click the mouse or press the Space bar to advance to the next monitor test pattern. Then turn up (turn clockwise) the SUB-BRIGHT (VR202) control until the raster is visible.
10. Display the Gray Bars test pattern on the monitor (see "MacTest Test Patterns").
11. **Figure 3-10.** Adjust the SUB-BRIGHT control until the first bar is black (as black as the screen border) and the second bar is barely visible.
12. Display the Full White Screen test pattern (see "MacTest Test Patterns").
13. Set the light meter range to "10 to 18" and check the luminance at the center of the screen (see "Using a Light Meter to Measure Luminance" later in this section). The reading should be at the top of the "10" scale. If the reading is not correct, be sure you have performed steps 1 through 10 correctly. If the steps have been performed correctly and the reading is still incorrect, adjust the SUB-CONTRAST control (VR201) clockwise or counterclockwise until the center of the all-white screen measures at the top of the "10" scale on the light meter. If you are unable to adjust the SUB-CONTRAST so that the reading is correct, perform the White Balance adjustment.

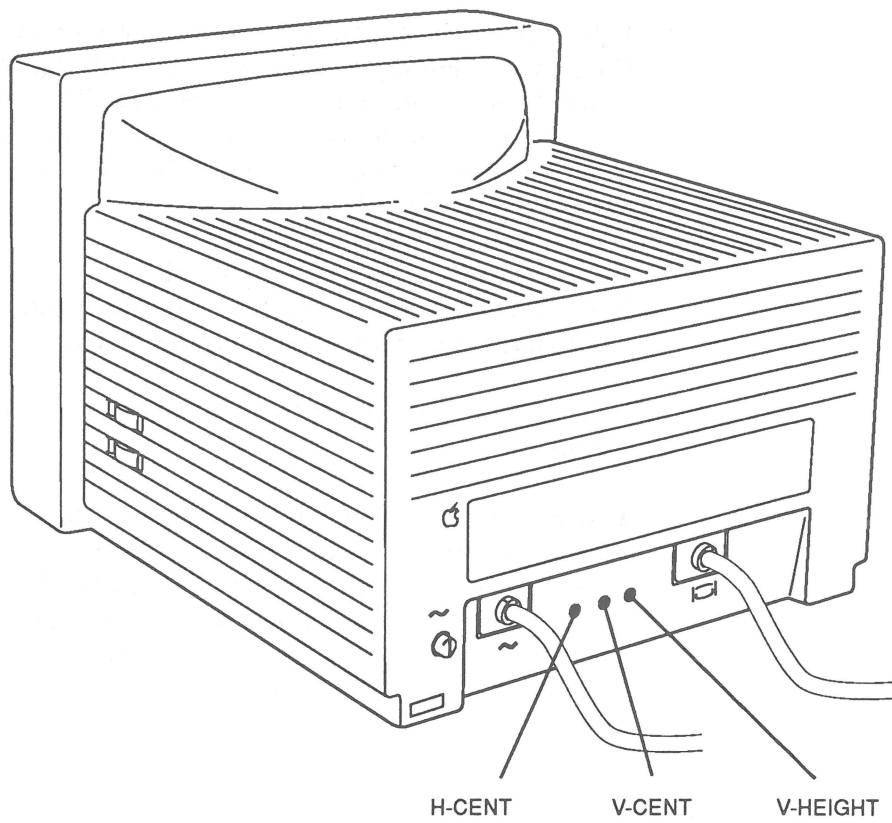


Figure 3-11 Size and Centering Adjustment Controls

Vertical Size

Vertical size, vertical center, and horizontal center are the only adjustments that can be performed without removing the rear cover. **All geometric tolerances must be within 2 mm (or 1/16") of the stated measurement.**

1. Display the Full White Screen test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-11.** Using the plastic adjustment tool, turn the V-HEIGHT control (VR404) until the raster is 153 mm (± 2 mm) or 6 1/16" ($\pm 1/16$ ") high.

Note: To measure the raster height, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the top edge of the raster as you keep your eye perpendicular to the zero mark. Holding the ruler in exactly that position, move your head so that your eye is perpendicular to the bottom of the raster, and note the ruler measurement. If necessary, adjust the V-HEIGHT control until the height of the raster is 153 mm (± 2 mm) or 6 1/16" ($\pm 1/16$ ").

Vertical Center

1. Display the Full White Screen test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-11.** Using the plastic adjustment tool, turn the V-CENT control (VR403) until the raster is positioned in the approximate center of the screen.

Horizontal Center

1. Display the Full White Screen test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-11.** Using the plastic adjustment tool, turn the H-CENT control (VR503) until the raster is positioned in the approximate center of the screen. **If the raster cannot be positioned in the center of the screen, set the H-CENT control at midrange (of the control) and perform the following steps.**

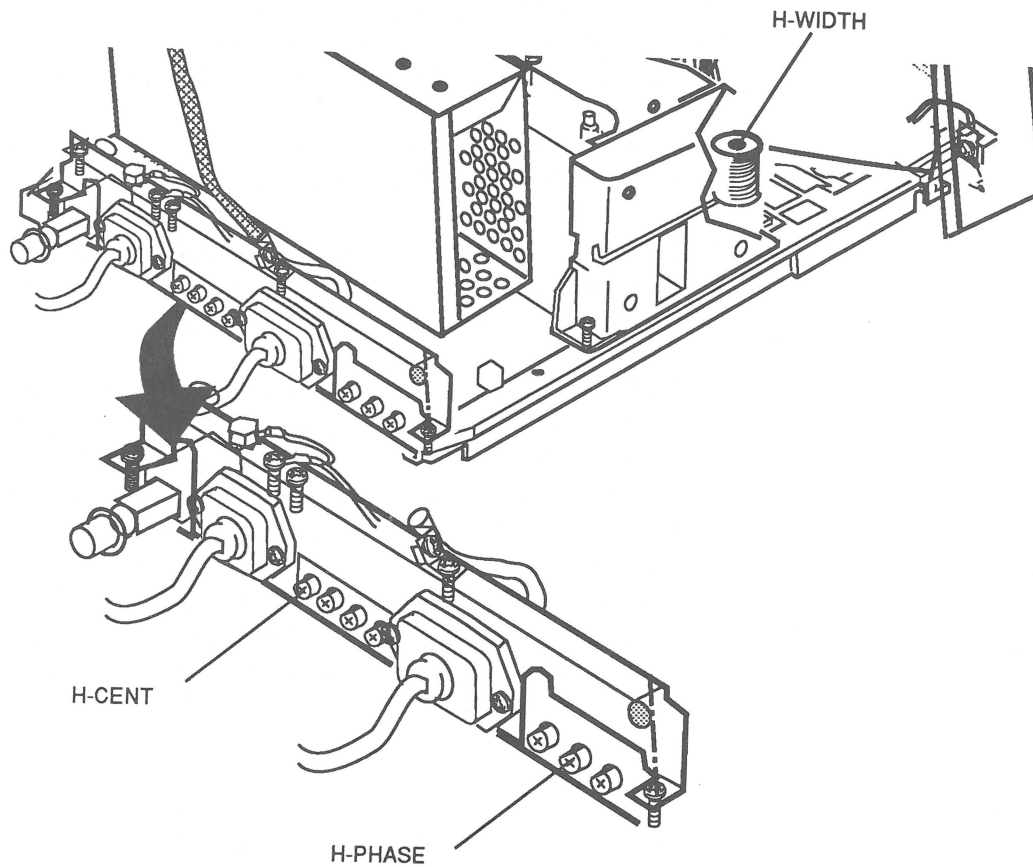


Figure 3-12 Horizontal Centering and Size Controls

3. Switch off monitor power and remove the rear cover (see Section 2, Take-Apart). Switch on monitor power.
4. **Figure 3-12.** Using the plastic adjustment tool, turn the H-PHASE control (VR501) until the raster is positioned at the **visual midpoint** of the range of the H-PHASE control.

Note: To locate the **visual midpoint** of the range of the H-PHASE control, locate the left and right limits of the control and note the position of the raster at each limit (the limits can be identified by a thin white band). Then adjust the H-PHASE control until the raster is positioned at the visual midpoint between the limits.

5. **Figure 3-12.** Using the plastic adjustment tool, turn the H-CENT control (VR503) until the raster is positioned in the approximate center of the screen.

Horizontal Size

1. Switch off monitor power and remove the rear cover (see Section 2, Take-Apart). Switch on monitor power.
2. Display the Full White Screen test pattern on the monitor (see "MacTest Test Patterns").
3. **Figure 3-12.** Using the hex-head insulated adjustment tool, turn the H-WIDTH control (L501) until the raster is 205 mm (± 2 mm) or 8 $\frac{3}{32}$ " ($\pm \frac{1}{16}$ ") wide.

Note: To measure the raster width, place a flexible metric ruler against the screen and align the zero mark of the ruler exactly over the left edge of the raster, keeping your eye perpendicular to the zero mark. Holding the ruler in exactly that position, move your head so that your eye is perpendicular to the right edge of the raster, and note the ruler measurement. Adjust the H-WIDTH control, if necessary, until the width of the raster is 205 mm (± 2 mm) or 8 $\frac{3}{32}$ " ($\pm \frac{1}{16}$ ").

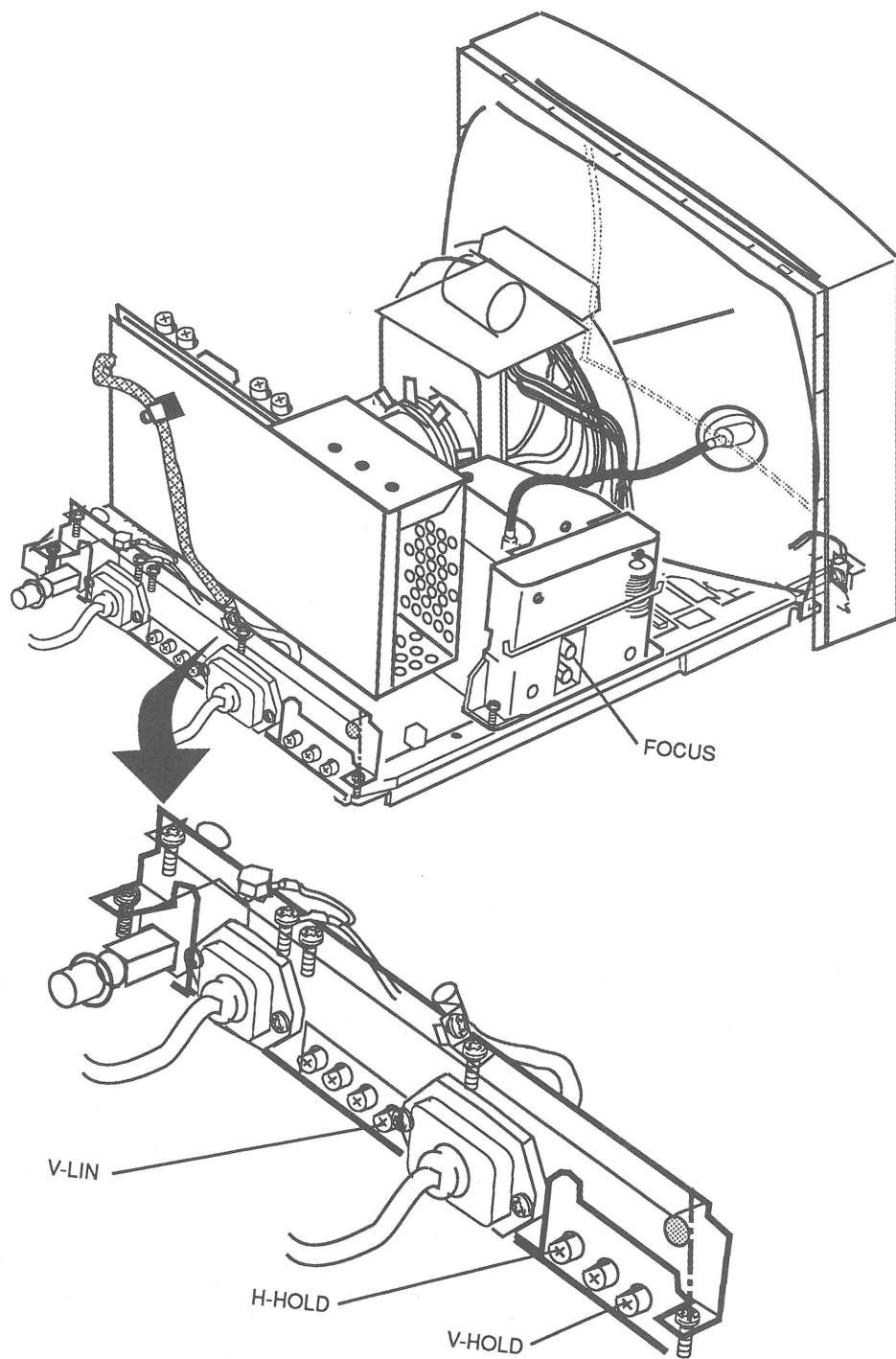


Figure 3-13 Linearity, Hold, and Focus Adjustment Controls

Vertical Linearity

1. Display the Crosshatch 1 (black background) test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-13.** Using the insulated screwdriver, turn the V-LIN control (VR402) so that the distance between the horizontal lines is the same at the top and at the bottom of the screen.

Vertical Hold

1. Display the All White Screen test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-13.** Using the insulated screwdriver, turn the V-HOLD control (VR401) until the raster stabilizes. To check the adjustment, turn the monitor power switch OFF, then ON. If the raster stabilizes immediately, the V-HOLD is correctly set.

Horizontal Hold

1. Display the All White Screen test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-13.** Using the insulated screwdriver, turn the H-HOLD control (VR502) until the raster stabilizes. To check the adjustment, turn the monitor power switch OFF, then ON. If the raster stabilizes immediately, the H-HOLD is correctly set.

Focus

1. Display the Focus test pattern on the monitor (see "MacTest Test Patterns").
2. **Figure 3-13.** Using the insulated screwdriver, turn the FOCUS control on the flyback transformer until the Focus test pattern is as clear as possible.

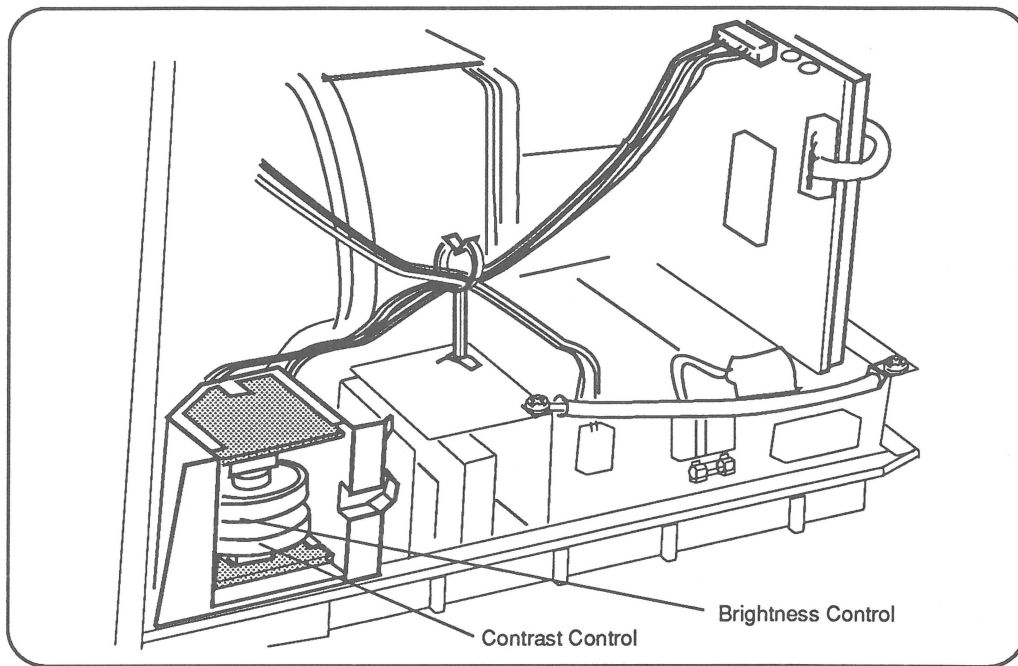


Figure 3-14 Brightness and Contrast Controls

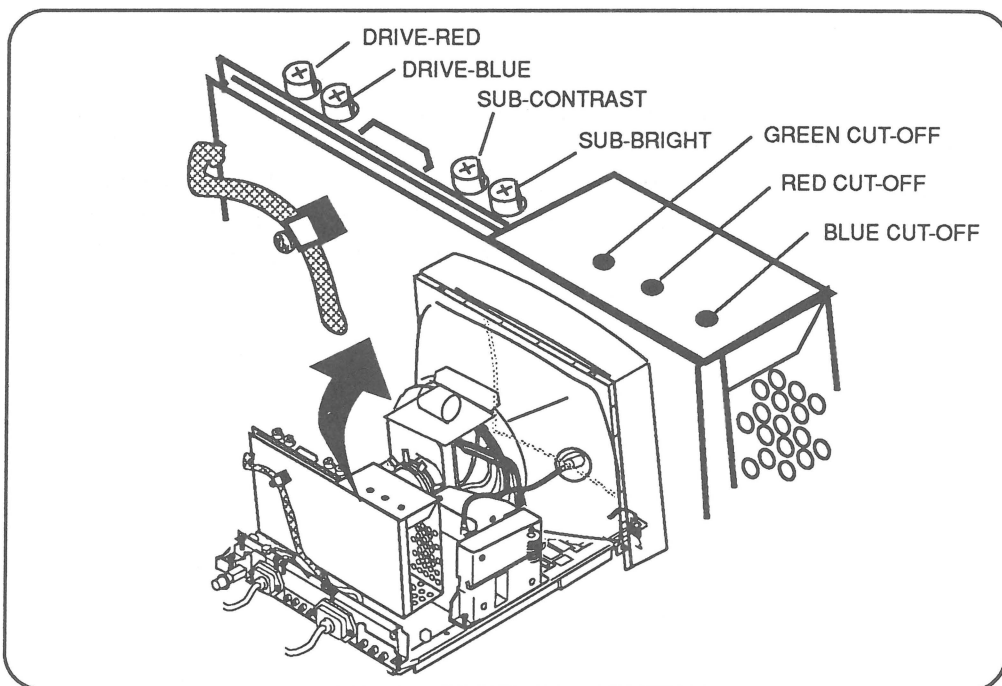


Figure 3-15 Video Adjustment Controls

IMPORTANT: *The following video adjustments should be performed in a dimly lit room after the monitor has been on for at least 10 minutes.*

White Balance

Make sure you have performed any necessary geometric adjustments before performing the white balance adjustments. The white balance adjustments should be performed **only if the color quality is unacceptable**. (Special equipment is required to attain perfect color adjustments.)

1. Switch off the monitor power and remove the rear cover (see Section 2, Take-Apart). Switch on monitor power and let the monitor warm up for at least 10 minutes.
2. Display the Full Black Screen test pattern on the monitor (see "MacTest Test Patterns").
3. **Figure 3-14.** Set the Brightness control to maximum brightness, and set the Contrast control to maximum contrast (turn the knobs away from the screen).
4. **Figure 3-15.** Preset these adjustment controls:
 - GREEN, RED, and BLUE CUT-OFF controls to minimum brightness (turn them counterclockwise to their limits)
 - DRIVE-RED and DRIVE-BLUE controls to midrange
 - SUB-CONTRAST control (VR201) to midrange
5. **Figure 3-15.** Adjust the SUB-BRIGHT control (VR202) until you cannot see the raster (turn the control down, or counterclockwise, as necessary), and then turn the SUB-BRIGHT control up (clockwise) until the raster is visible.
6. **Figure 3-15.** If the entire screen is not tinted green (but dark), adjust the GREEN CUT-OFF control until green is the predominant color. **(The entire screen should be obviously tinted green, but dark.)**

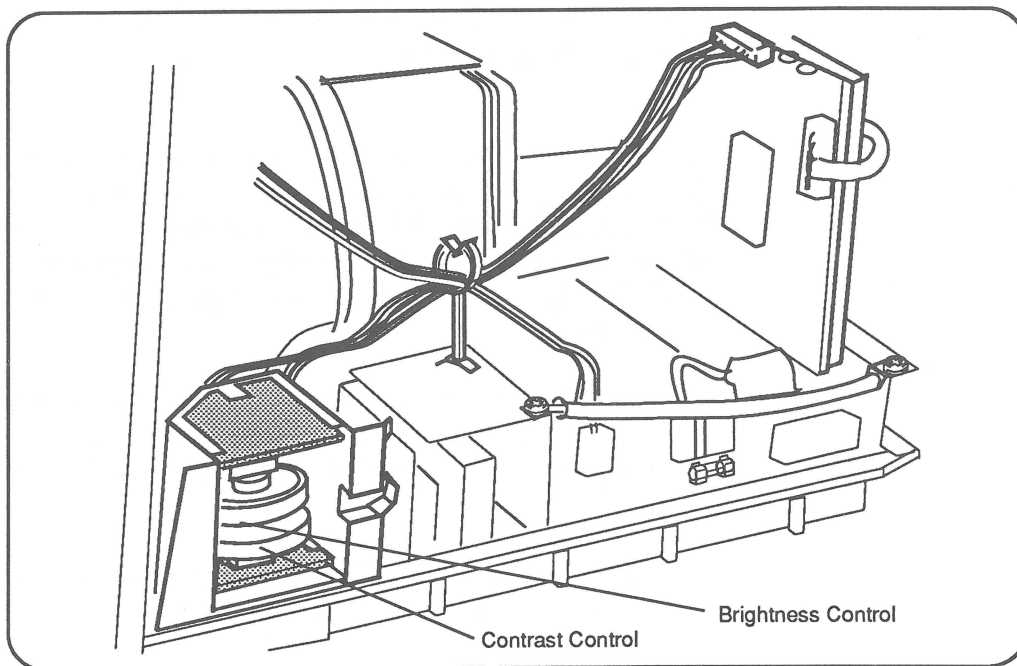


Figure 3-16 Brightness and Contrast Controls

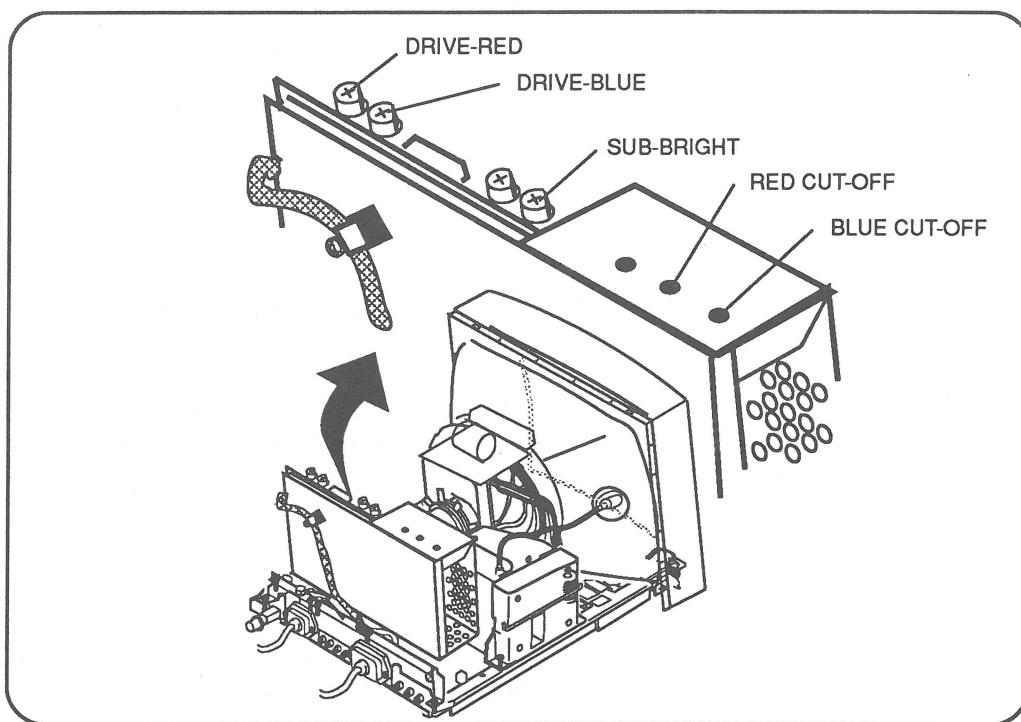


Figure 3-17 Video Adjustment Controls

7. Display the Gray Bars test pattern on the monitor (see "MacTest Test Patterns").
8. **Figure 3-16.** Set the Brightness control to its detent position. To find the detent position, turn the knob fully clockwise, then counterclockwise. The place in the middle where the knob hesitates is the detent position.
9. **Figure 3-17.** Alternately adjust the RED and BLUE CUT-OFF controls until there is no predominant color (no colored tint) in the left three bars.

Also check that the left-most bar is black (it should match the screen border). If the left-most bar is not black, turn the SUB-BRIGHT control (VR202) counterclockwise until the left-most bar is as black as the screen border.

Note: If the SUB-BRIGHT control cannot be set properly in the preceding step, stop the adjustment procedure and repair the monitor. Refer to Section 4, Troubleshooting.

10. If there is no predominant color in any of the gray bars, go to step 13 and set screen luminance. If there is a predominant color (colored tint) in the right (brightest) three bars, proceed with the next step.
11. **Figure 3-17.** Alternately adjust the two drive controls—DRIVE-RED and DRIVE-BLUE—until there is no predominant color (no colored tint) in the right (brightest) three bars.
12. If there is now a predominant color in the left (darkest) three bars, return to step 2 and repeat the White Balance adjustments. If there is no predominant color in the three left bars, go to the next step.

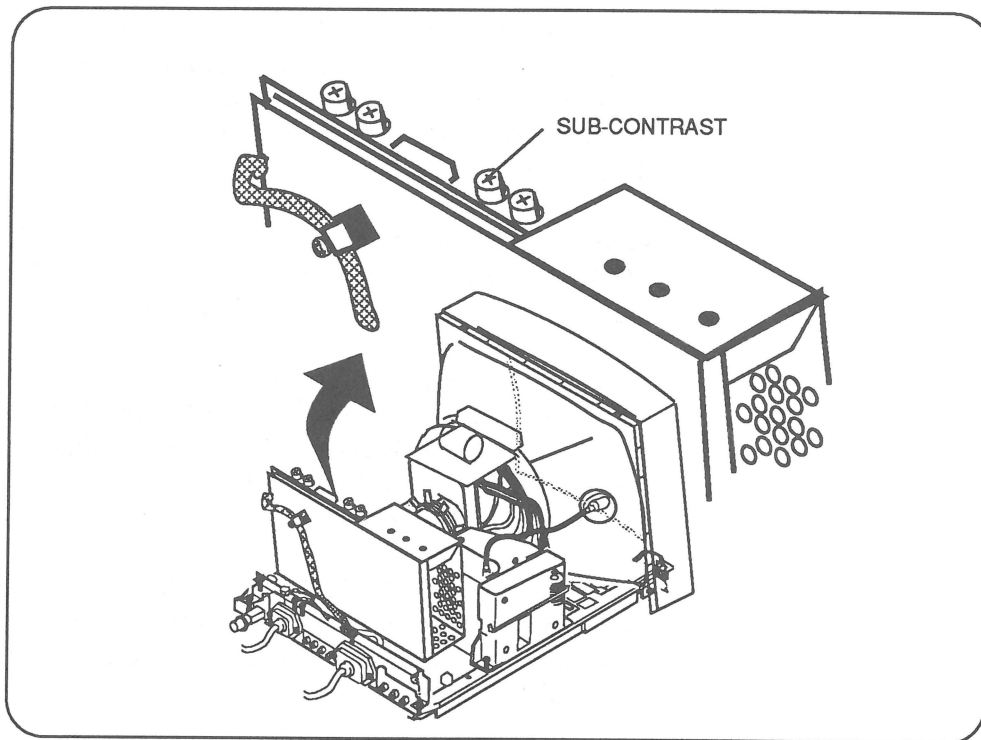


Figure 3-18 SUB-CONTRAST Control

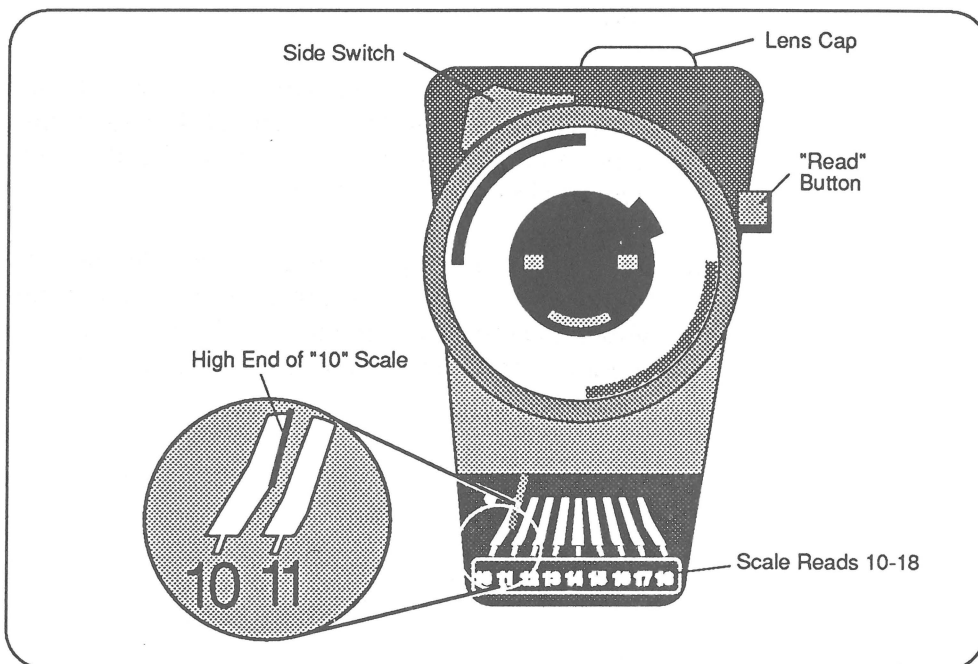


Figure 3-19 Using the Sekonic Light Meter

13. Display the All White Screen test pattern on the monitor (see "MacTest Test Patterns").
14. **Figure 3-19.** Set the light meter so that the lower scale reads 10 through 18. Refer to "Using Light Meter to Measure Luminance" below for more information.
15. **Figure 3-18.** Now adjust the SUB-CONTRAST control (VR201) clockwise or counterclockwise until the center of the all-white screen measures at the top of the "10" scale on the light meter.

Note: The white balance is properly adjusted if:
 - There is no predominant color in the gray bars
 - The center of the all-white screen measures at the top of the "10" scale on the light meter
 - The left-most three bars are, respectively, black (furthest-left bar), barely visible, and dark gray.
16. Quit the test program, switch monitor power off, and replace the rear cover (see Section 2, Take-Apart).

Using a Light Meter to Measure Luminance

Figure 3-19. Use the light meter to measure luminance as follows:

1. First, to ensure that the light meter is functioning correctly, press the red button on the back of the unit. If the reading is out of the red area, replace the battery.
2. Next, move the side switch to its upper position so that the lower scale reads 10 through 18.
3. Uncover the lens of the light meter. Place the lens against the screen exactly over the brightest (right-most) bar, and press the Read button. The reading should fall at the top of the "10" scale.

Macintosh 12-Inch RGB Display

Section 4 – Troubleshooting

❏ CONTENTS

- 4.2 Introduction
- 4.3 Monitor Inspection
- 4.4 Geometric Alignment Chart
- 4.5 Symptom Chart

□ INTRODUCTION

The monitor inspection procedure that follows should be performed whenever you replace a defective module in the Macintosh 12-Inch RGB Display. This procedure helps you identify common adjustment problems, and refers you to a geometric alignment chart and a symptom chart for solutions.

The geometric alignment chart uses graphic representations of display screens with misaligned rasters to demonstrate common geometric adjustment problems. The chart also identifies the adjustment that you can use to correct each illustrated problem.

The symptom chart for the Macintosh 12-Inch RGB Display lists common problems and their solutions. Find the best description of the symptom(s) your defective monitor is displaying; then try the recommended actions in the order listed. If the first corrective action does not solve the problem, reinstall the original module or part before you try the next action.

Note: Raster refers to the lit portion of the screen that looks like a blank white box when no video is displayed. Video, which is generated outside the monitor, is displayed over the raster and usually masks the raster.

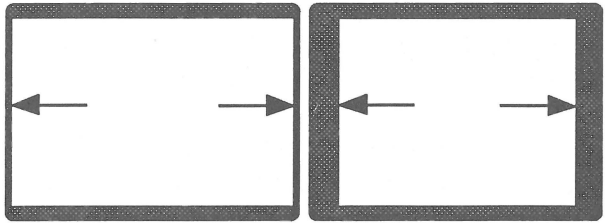
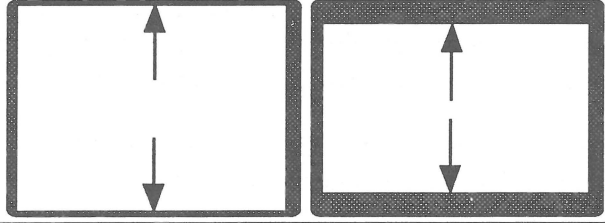
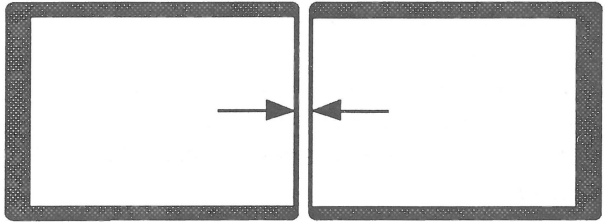
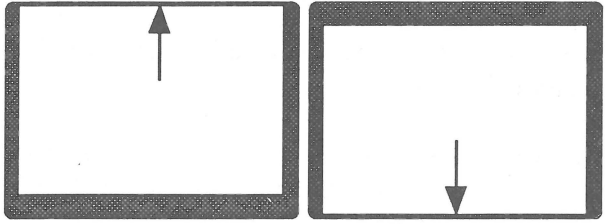
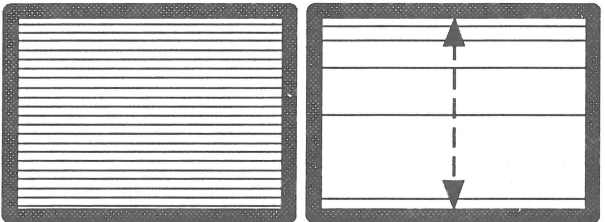
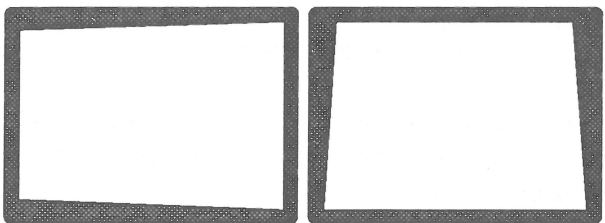
Monitor Inspection

Perform the following inspection whenever you replace a defective module in the Macintosh 12-Inch RGB Display. Refer to the symptom chart for a complete list of monitor problems (symptoms) and solutions.

1. Perform the Screen Adjustment procedure. The screen adjustment procedure should be performed **only** if one or more of the following conditions is true:
 - You have replaced the main deflection board
 - You have inadvertently altered the screen adjustment
 - You have replaced the CRT/yoke assembly with a CRT/yoke assembly from a different vendor (see Adjustments section for more information)
2. Successively display the Full White Screen, Crosshatch 1 (black background), and Focus test patterns on the monitor. (Refer to "MacTest Test Patterns" in Section 3, Adjustments.)
3. Check the display for geometric alignment, linearity, and focus adjustment problems. For more information, refer to "Geometric Alignment Chart" in this section.
4. Display the Gray Bars test pattern on the monitor. (Refer to "MacTest Test Patterns" in Section 3, Adjustments.)
5. Set the Brightness control at its detent position, and set the Contrast control at maximum (turn the knob away from the screen).
6. Check that the following conditions are true:
 - The left-most bar is completely black (like the border), and the bar next to it is barely visible
 - The right-most bar measures at the top of the "10" scale on the light meter (see Section 3, Adjustments)
 - The Gray Bars display has no predominant color

If these conditions are not met, perform the video adjustments (Cutoff and White Balance) or refer to the symptom chart.

□ GEOMETRIC ALIGNMENT CHART

	Raster too wide or too narrow
	Adjust H-WIDTH (L501) to 205 mm \pm 2 mm)
	Raster too tall or too short
	Adjust V-HEIGHT (VR404) to 153 mm \pm 2 mm)
	Raster shifted to the right or left
	Adjust H-CENT (VR503)
	Raster shifted up or down
	Adjust V-CENT (VR403)
	Raster has horizontal stripes (far left)
	Adjust H-HOLD (VR502)
	Raster moves vertically (near left)
	Adjust V-HOLD (VR401)
	One side shorter than side opposite ("Keystone" effect)
	Replace the CRT

□ SYMPTOM CHART

Raster Problems

Solution

- *No raster*
 1. Adjust Contrast and Brightness user controls.
 2. Ensure that all connectors are secure on main deflection board and CRT video board.
 3. Replace external power cable assembly.
 4. Check fuse and replace if blown. If fuse blows again, go to next step.
 5. Perform Screen Adjustment procedure.
 6. Replace main deflection board.
 7. Replace CRT video board.
 8. Replace CRT.

- *Raster size too short/tall, narrow/wide*
 1. Adjust V-HEIGHT or H-WIDTH controls (as appropriate) on the main board.
 2. Replace main deflection board.
 3. Replace CRT.

- *Raster not centered*
 1. Adjust H-CENT or V-CENT external controls.
 2. Replace main deflection board.

- *Single vertical or horizontal line appears*
 1. Verify that yoke connector **DY** is tight.
 2. Replace main deflection board.
 3. Replace CRT.

- *Horizontal linearity bad (screen sides differ)*
 1. Replace main deflection board.
 2. Replace CRT.

- *Vertical linearity bad (screen top and bottom differ)*
 1. Adjust V-LIN control on main board.
 2. Replace main deflection board.
 3. Replace CRT.

- *Raster size small and abnormally bright*
 1. Verify that yoke connector **DY** is tight.
 2. Replace main deflection board.
 3. Replace CRT.

Raster Problems (continued)

Solution

- *Abnormal/distorted raster (other than above)*
 1. Ensure that all connectors are correctly placed and secure.
 2. Perform geometric adjustments.
 3. Replace main deflection board.
 4. Replace CRT video board.
 5. Replace CRT.
- *Picture breaks in diagonal lines*
 1. Adjust H-HOLD control on main board.
 2. Replace main deflection board.
 3. Replace CRT video board.
- *Picture rolls vertically*
 1. Adjust V-HOLD control on main board.
 2. Replace main deflection board.
 3. Replace CRT video board.

Video Problems

Solution

- *Predominant red, blue, or green color tint*
 1. Perform white balance adjustments according to procedure given in Section 3, Adjustments.
 2. Replace CRT video board.
 3. Replace CRT.
- *Picture too dark or too bright*
 1. Adjust Brightness and Contrast user controls.
 2. Perform Screen Adjustment procedure.
 3. Perform video adjustments (Cutoff and White Balance) according to procedure given in Section 3, Adjustments.
 4. Replace main deflection board.
 5. Replace CRT video board.
 6. Replace CRT.
- *Brightness, contrast, or color cannot be adjusted*
 1. Replace contrast/brightness assembly.
 2. Replace main deflection board.
 3. Replace CRT video board.

Miscellaneous Problems

Solution

- *No power
(LED does not light)*
 - 1. Check external power source and connection.
 - 2. Check internal power connectors.
 - 3. Check fuse and replace if blown. If it blows again, go to next step.
 - 4. Replace main deflection board.
 - 5. Replace CRT video board.
 - 6. Replace CRT.

- *Intermittent shutdown*
 - Replace main deflection board.

- *Picture jitters or flashes*
 - 1. Ensure that all ground cables are secure.
 - 2. Ensure that adjacent computer equipment is properly grounded. Move other electrical devices out of close proximity.
 - 3. Replace main deflection board.
 - 4. Replace CRT video board.

- *Flashing or wavy screen*
 - 1. Crimp metal connector tabs on video connector.
 - 2. Replace main deflection board.

- *Black screen spots (burnt phosphor)*
 - Replace CRT.

- *Monitor emits high-pitched noise*
 - Replace main deflection board.

- *Out of focus*
 - 1. Adjust Focus control on flyback transformer.
 - 2. Perform Screen Adjustment procedure.
 - 3. Replace main deflection board.
 - 4. Replace CRT video board.
 - 5. Replace CRT.

Macintosh 12-Inch RGB Display

Illustrated Parts List

□ CONTENTS

IPL.3 Macintosh 12-Inch RGB Display – System
Exploded View (Figure 1)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Macintosh 12-Inch RGB Display, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

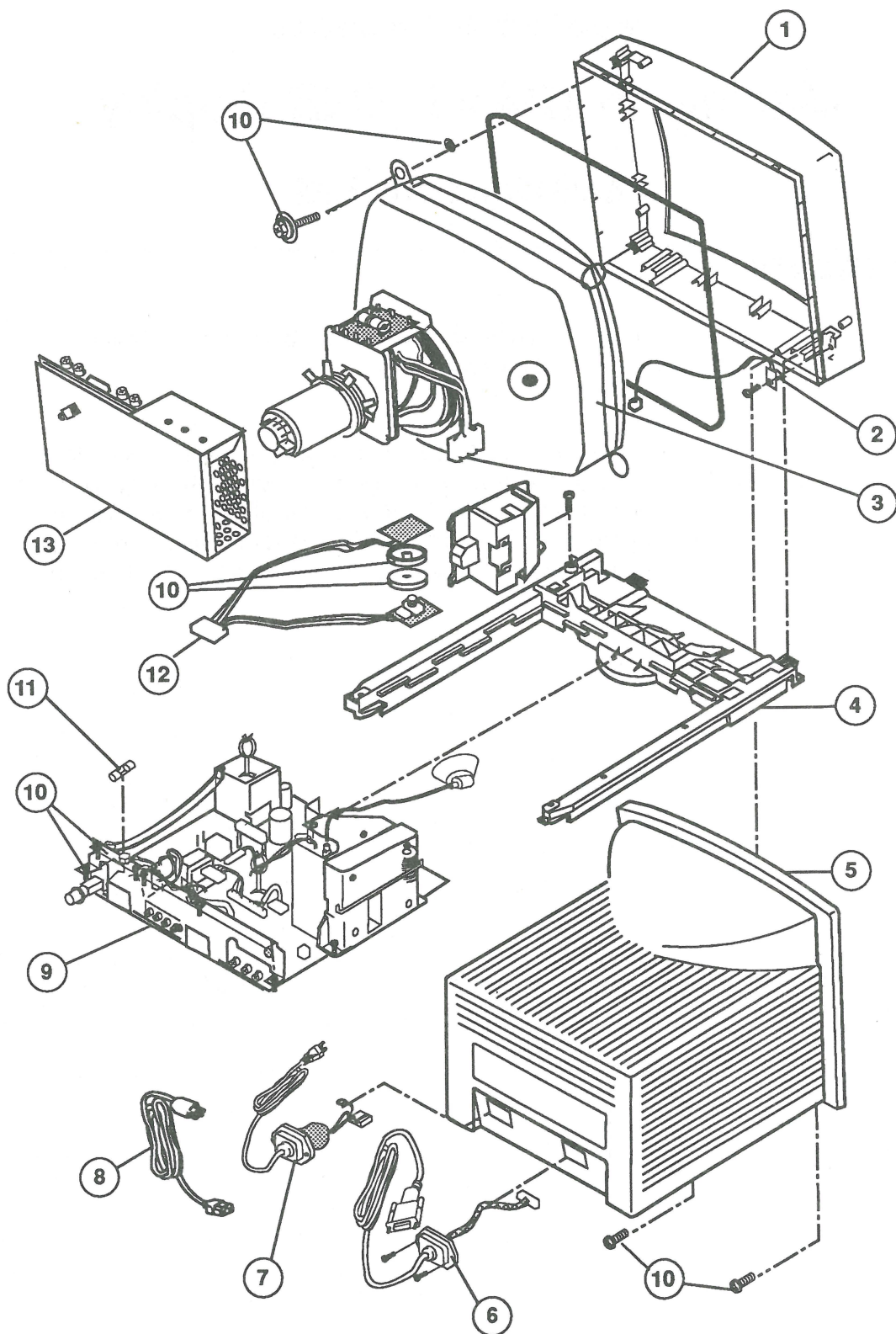


Figure 1 Macintosh 12-Inch RGB Display

□ **MACINTOSH 12-INCH RGB DISPLAY – SYSTEM EXPLODED
VIEW (Figure 1)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	949-0297	Bezel, Plastic Case
2	930-0008	LED Assembly with Cable
3	076-0384	CRT Assembly, Domestic
	076-0385	CRT Assembly, Europe
	076-0386	CRT Assembly, Australia
4	949-0304	Main Board Holder, Plastic
5	949-0298	Rear Cover, Plastic, Domestic
	949-0303	Rear Cover, Plastic, International
6	590-0693	Cable, CPU-to-Monitor
7	590-0370	Cable, External Power, Hi-Res (1 M)
8	590-0420	Cable, Power, European (1 M)
9	661-0616	Main Deflection Board, Domestic
	661-0617	Main Deflection Board, International
10	956-0024	Screw/Knob Set
11	941-5222	Fuse, 125 V 3.15 A slow blow, Domestic
	941-5223	Fuse, 250 V 3.15 A normal blow, International
12	905-0009	Contrast/Brightness Assembly
	905-0010	Contrast/Brightness Assembly, International
13	661-0618	CRT Video Board
	661-1618	CRT Video Board, International